FOLSOM LAND USE PATTERNS IN THE CENTRAL PLAINS

By

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Abstract

Folsom people lived in the Plains regions from 10,950 to 10,250 RCYBP. The calibrated radiocarbon ages for Folsom range between 12,900 to 12,000 years BP. In order to study Folsom land use in the Central Plains this study performs regional analyses of Paleoindian surface finds.

Few stratified Folsom or early Paleoindian cultural deposits have been recorded in the Central Plains of Kansas and Nebraska (Blackmar and Hofman 2006; Hofman and Graham 1998), although many Paleoindian projectile points have been found in the region (Hofman 1996; Mandel 2008:342). Regional analyses are paramount to studying large scale land use patterns of Folsom culture in the Central Plains and Plains region (Amick 1994; Hill 2007; LeTourneau 2000; Meltzer 2006:16; Andrews et al. 2008). Accurate documentation and study of diagnostic Folsom artifacts (projectile points, preforms, and channel flakes) from both site and non-site contexts are required in order to perform regional analyses. The use of surface collections is key in addressing questions at a regional scale, especially in Nebraska which has no stratified or well-documented sites. As such, the study of surface artifacts offers the current best opportunity to study Folsom land use and organization in Nebraska and the Central Plains region.

This study gives a description of the Central Plains Folsom dataset and what it represents and concludes by considering how this study's dataset supports, enhances, or varies from the expectations of previous models of Folsom land use and technological organization.

Dedication

I dedicate this dissertation to my Dad, Anthony (Tony) Wayne Williams. Thank you, from the bottom of my heart, for all your help throughout my college education.

Acknowledgments

I would like to thank my adviser, Dr. Jack Hofman, for his time, guidance, patience, and feedback throughout the dissertation process and graduate school years. I know this is a much better dissertation because of all of your input. I would also like to thank my committee members Dr. Frédéric Sellet, Dr. Dan Amick, and Dr. Rolfe Mandel for giving their time, thoughtful feedback, comments, and suggestions. I would like to thank Dr. Terry Slocum, my outside committee member for his time, feedback, and willingness to serve on my committee at the last minute.

There are several dozen avocational archaeologists that have made this work possible and I would like to thank them all. Because of privacy issues I am not listing their names here. I would like to thank Dr. Steve Holen and Kevin Hammond for sending me information about additional Folsom artifacts for this project. I thank Rhonda Houser for her kindness and GIS knowledge, tips, and tricks that she shared with me. The maps in this dissertation would not have been possible without her imparting some of her extensive GIS skills and knowledge.

Also, I thank my friend and mentor, Dr. Mary Adair, for her support, friendship, and mentoring throughout the years. I also thank Dr. Adair for being the best darn carpool buddy a girl could have. I thank my many fellow graduate students and friends, you are too many to name here, but I thank each and every one of you. I want to thank my friend Dr. Shawna Chapman—you always knew I could do it and you were right.

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Chapter 1: Introduction and Background to the Study Area

Introduction

Folsom people are early Paleoindian hunter-gatherers who lived in the Plains regions of North America from 10,950 to 10,250 RCYBP (Haynes et al. 1992:96; Holliday 2000; Meltzer 2006). The calibrated radiocarbon ages for Folsom range between 12,900 to 12,000 years BP (Taylor et al. 1996). This dissertation performs regional analyses in order to study Folsom land use in the Central Plains. This dataset of diagnostic Folsom artifacts is from the state of Nebraska, but Folsom people probably did not live their entire lives in Nebraska. Common lithic materials represented in the sample are from source areas outside of Nebraska, hence the study of land use in the Central Plains. This work focuses on the Folsom culture because no comparable datasets exist (i.e. regional, non-site datasets) for the Central Plains for Agate Basin, Allen, and Cody, etc. However, this study includes a comparison of Folsom to Clovis in the Central Plains in terms of distribution, as Holen (2001) has studied Clovis evidence in the Central Plains. Climatic and ecological differences between Clovis and Folsom time in the region may, however, have been substantially different.

Statement of the Problem

In the southern and western High Plains, numerous stratified Paleoindian sites have been recorded (Holliday 2000; Albanese 2000; Mandel 2008:342). In contrast, many Paleoindian projectile points have been found in the Central Plains of Kansas and Nebraska (Hofman 1996; Mandel 2008:342), few stratified Folsom or early Paleoindian cultural deposits have been recorded in the region (Blackmar and Hofman 2006; Hofman and Graham 1998).

Regional analyses are needed to study large scale land use patterns of Folsom culture in the

Plains region (Amick 1994; Hill 2007; LeTourneau 2000; Meltzer 2006:16; Andrews et al. 2008). In order to perform such regional analyses, accurate documentation and study of diagnostic Folsom artifacts (projectile points, preforms, and channel flakes) from site and non-site contexts are required. The use of surface collections is of key importance in addressing questions at a regional scale, especially in Nebraska. According to the Nebraska State Historical Society records, only twelve Folsom sites have been recorded in the state. The highest level of archaeological work conducted at these sites varied; eight were surveyed by a professional archaeologist, one was tested, and three were reported. Extensive excavations were not conducted at any of these sites (Nelson 2015). According to Bozell (1994:90), "Intact Clovis or Folsom sites have not been discovered in Nebraska." Therefore, the study of surface artifacts offers the current best opportunity to study Folsom land use in Nebraska and the Central Plains region.

The primary goal of this dissertation is to use regional analysis to study organization and land use patterns of Folsom people who lived in the Central Plains. This dissertation will evaluate potential reasons for the very uneven distribution of Folsom evidence in the region as it is now documented. The current sample lacks evidence for Folsom artifacts for the northeastern, north central, and other portions of Nebraska. Andrews et al. (2008) also provide an example of regional archaeology and shows gaps in the Nebraska area. This study has a greatly expanded Nebraska Folsom dataset as compared to the sample presented in Andrews et al. (2008).

The locations for many Folsom surface finds are recorded to the county level or general locality—rather than from specific site contexts. Nonetheless, the surface artifacts in this database provide the best available documentation of the Folsom archaeological record within the Central Plains region, and so provide the best available evidence for interpreting aspects of Folsom behavior on a regional scale. Such study would not be possible if it were limited to excavated or site-based assemblages (Williams and Hofman 2010). I acknowledge the arguments (e.g., Bamforth 2009; Sellet 2004; Speth et al. 2010) made about limitations of studying projectile points exclusive to other artifact classes. However, because this sample is from surface contexts, it is limited to only diagnostic Folsom artifacts including projectile points, preforms, and channel flakes.

What the Nebraska Folsom Sample Represents

The current sample of Folsom artifacts for Nebraska consists of 306 artifacts, including 249 projectile points and point fragments, 48 preforms, and 9 channel flakes. This database consists of surface collections documented in publications and private and institutional collections. In general, surface artifact collections have limited contextual information (Sellet 2006:224), which is the case for this sample. The sample is composed entirely of weaponry-related artifacts (projectile points, preforms, and channel flakes). The locational information for the artifact sample is primarily at the county, locality, and site levels. The majority of the sample is composed of isolated finds and a few localities. Only a few recorded "sites" are represented in the sample, and these also have surface-derived collections.

The Folsom artifacts in this study are partitioned into ecological regions (or ecoregions) and along the North and South Platte Rivers of Nebraska in order to compare the differing patterns among the Folsom artifact samples found across the area. The ecological regions represented in Nebraska include: the Central Great Plains, Nebraska Sand Hills, Northwestern Glaciated Plains, Northwestern Great Plains, Corn Belt Plains, and Western High Plains (Figure 1.1, Table 1.1). This geographic partitioning provides the means for an initial assessment of the evenness of Folsom archaeological evidence across the physiographically diverse Central Plains (Nebraska) region. This distribution enables the recognition of artifact concentrations and gaps across the region and serves as a starting point for further evaluation and investigation, which may eventually include detailed paleo-ecological evidence. No implication exists that these modern ecoregions correspond to specific habitats during Folsom time. These regions are linked to soils, physiography, and drainages and *may* have varied with distinctive ecologies during Folsom time.

The artifacts in the Central Plains Folsom sample encompass a scale that is also temporally expansive. The artifacts could be from throughout the Folsom time period, so the entire time scale of approximately 900 years of land use by Folsom people is assumed for this study. Temporally, this study looks at land use on the scale of many centuries to assess redundant and recurrent regional land use patterns, based on the types of tools and lithic materials left by Folsom peoples in the Central Plains. This study relies upon the Folsom time span as reported by Haynes et al. (1992:96) who reported uncalibrated radiocarbon ages from 10,950 to 10,250 bp from dates on charcoal from nine Folsom sites. The calibrated radiocarbon ages from these same nine sites range from 12,900 to 12,000 years BP (Taylor et al. 1996). This would give Folsom a 900 year time span. Holliday (2000:227) reports that the age of Folsom on the Southern Great Plains dates from 10,900 to 10,100 RCYBP, and on the Northern Great Plains, Folsom dates from 10,900 to 10,200 RCYBP. Meltzer (2006:146-147) dated charcoal samples from the Folsom site and these samples ranged from 10,010 to 11,370 RCYBP. Six samples of bison bone from the site were dated and the mean age range for these samples was 10,490 ± 20 RCYBP. Meltzer's reassessment of dates from the Folsom site concluded that the charcoal yielded age ranges that were a maximum age of the deposits, as charcoal "can be older than the sediments in which it was embedded" (Meltzer 2006:147). Therefore, based on the bones that were directly dated, he concluded that the age of the bison kill at the site was ~10,500 RCYBP.

The Central Plains Folsom dataset also encompasses a large geographic region, including the entire state of Nebraska and lithic source areas outside the state. This provides an appropriate geographic scale to address large-scale regional land use strategies because it contains a broad diversity of physiographic regions (or ecoregions) and resources. The state of Nebraska covers an area of 200,282 km^2. Obviously, land use by Folsom peoples was not restricted by modern state boundaries; their economic territories overlapped in various ways with Nebraska as indicated by commonly used lithic source areas that occur outside the state.

Research Goals and Research Questions

This dissertation has two research goals with several research questions under each. Research goals are as follows: 1) To evaluate modern factors and formation processes that may have impacted the Folsom archaeological record and 2) To evaluate the evidence for Folsom group behavior and land use based on the archaeological record of Folsom in the Central Plains. Specifically, how can the analysis of chipped stone artifacts inform us about large-scale land use, organization, and mobility of Folsom people in this region?

Goal #1: To evaluate modern factors and formation processes that may have impacted the Folsom archaeological record.

Before this study could address research goal #2, we must first consider factors other than Folsom peoples' behaviors; e.g., modern population, contemporary land use practices, landform changes, and potential sampling bias based on archaeological research activity, that may have influenced the record.

Research Question 1.1 to address Goal #1: Does modern population density have a positive correlation with the Folsom artifact distribution in Nebraska?

Methods to address Research Question 1.1. It is assumed that modern population has the potential to affect the visibility of the Folsom archaeological record. Thus, it is important to consider whether modern population is a factor affecting the documentation of Folsom artifacts. Since most artifact collectors presumably hunt primarily close to where they live, modern population density may be predicted to correlate with the number of collectors hunting in that area (c.f., Prasciunas 2008). If so, the higher the population, other factors being equal, the greater the chances of Folsom artifacts being found in that area. In order to answer this research question, population density was derived for each county in Nebraska by dividing the total population of each county by the land area per county. Population information for each county with Folsom artifacts in Nebraska was derived from the U.S. Census Bureau using 1950 figures—the time when many of these artifacts were found and believed to be a better estimate than current population to characterize overall 20th century population. Pearson's product-moment correlations were used to assess whether modern population density had a positive correlation with the known Folsom artifact distribution in Nebraska.

Research Question 1.2 to address Goal #1: Do contemporary land use practices, specifically land under cultivation, have a positive correlation with the Folsom artifact distribution in Nebraska?

Methods to address Research Question 1.2. It is generally assumed that land under cultivation increases the surface visibility of the archaeological record, and therefore, the greater the amount of land under cultivation in an area, the greater chances that artifacts will be found on the surface. Thus, it is important to consider whether cultivation is a factor affecting the visibility of the Folsom archaeological record. In order to answer the research question, the total acreage of cultivated land for each county with Folsom artifacts in Nebraska was extracted from the U.S. Department of Agriculture 1950 Census of Agriculture. Cultivated acreage was converted into km^2. Then a percentage of county area under cultivation was derived by dividing the land area under cultivation by the total county land area. Pearson's product-moment correlation was calculated to assess whether cultivated land had a positive correlation with the distribution of Folsom artifacts in Nebraska found in upland contexts. Only Folsom artifacts found in non-riverbed contexts were considered to assess this research question, as artifacts that come from active river channels may be independent of landuse—that is, land under cultivation is presumably not a factor for visibility of these artifacts.

Research Question 1.3 to address Goal #1: What is the impact of potential sampling bias based on archaeological research activity?

Methods to address Research Question 1.3. The potential sampling bias based on archaeological research activity was assessed by examining the total number of archaeological sites (excavated and surface sites) reported per county and this frequency was compared with the distribution of surface Folsom diagnostic artifacts to assess potential correlations by county. The Nebraska archaeological site file database was used to assess the number of recorded prehistoric sites per county, as a general measure of professional archaeological activity. The goal was to assess potential sampling bias based on archaeological research activity.

Goal #2: Evaluate the evidence for Folsom group behavior and land use based on the archaeological record. Specifically, how can the analysis of chipped stone artifacts inform us about large-scale land use, organization, and mobility of Folsom people in the Central Plains?

Specific Questions to Address Research Goal #2. After considering the above post-depositional and biasing variables and assessing the distribution of Folsom artifacts, what patterns remain and how may these patterns inform us about Folsom group behavior? What evidence is there which might pertain to the behavior and land use of Folsom people? The following questions were addressed: Can the concentration of Folsom evidence near the confluence of the North and South Platte rivers be attributed entirely to factors other than the behavior of Folsom people? Does the concentration of Folsom artifacts near the confluence of the North and South Platte Rivers reflect Folsom activity rather than other variables—such as geomorphic processes, modern population, land under cultivation, or problems with sampling? Were Folsom people living in the area continuously, or were they exploiting specific areas in Nebraska on a seasonal basis? Were Folsom people settling in the Rocky Mountain foothills and then using the High Plains for hunting (c.f., Amick 1994)? How would the Folsom archaeological record differ if they were living in Nebraska year round versus only seasonally? Is the direction of resource use (from lithic material source areas) proportionately equal from the west, east, north, and south (in proportion to the availability of lithic materials)? Is there evidence for staging of Folsom projectile point production, and if so how does this evidence pattern? These questions were addressed when considering the evidence for Folsom land use based on the archaeological record of Folsom in Nebraska.

Goals of My Contribution

Spatial studies of surficial datasets are key to regional studies in archaeology (Ebert 1992). Folsom artifacts can function as horizon markers across extensive landscapes for GIS based studies. One of the goals of this dissertation is to further demonstrate the usefulness of using surface collections to study land use at large regional scales. Surface collections should be viewed as a significant source of information (see Dunnell and Dancey 1983) which can contribute to understanding and interpreting land use at large regional scales such as the Central Plains. This is true even when excavated assemblages are available for acquiring distributional information. Interpreting distributional patterns in Folsom artifacts was done with consideration of the potential influence of ecological regions, historic land use practices, modern population, and prehistoric behavior. Folsom land use patterns identified here were compared to those of previous studies and revealed elements of similarity and diversity in Folsom techno-cultural systems. This study evaluated models, using the Nebraska area dataset, which have been offered for Folsom organization and technology.

Background on Using Modern Ecoregions and Paleoenvironment

This study uses modern ecoregions (Figure 1.1, Table 1.1), to divide the Central Plains Folsom artifact sample into broad environmental regions. The GIS ecoregion data was downloaded from the U.S. Environmental Protection Agency website (www.epa.gov/wed/pages/ecoregions.htm). The modern ecoregions of Nebraska are almost identical to the physiographic subprovinces for the state of Nebraska depicted in Mandel's (2008:343) map of the physiographic subprovinces of the Central Plains. The modern ecoregions are defined based on geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The Folsom time period (10,950–10,250 RCYBP) falls within the Younger Dryas episode (11,000–10,000 RCYBP). The specific characteristics of modern ecoregions are not presumed to carry back to the Younger Dryas, but the boundaries of the ecoregions are a proxy for the late Pleistocene/early Holocene time period in Nebraska (Martin 2010). The modern ecoregions evolved throughout the late Pleistocene and Holocene and maintained these boundaries due to the vagaries of topography, drainage, and overall climate patterns (Widga 2010). Currently, there is no paleoenvironmental/vegetation map for the Younger Dryas for the Central Plains. The available evidence for the Central Great Plains area is simply inadequate to generate an accurate paleoecological map for the region during the Younger Dryas. For example, in Meltzer and Holliday's (2010:10) map of Younger Dryas paleoenvironmental records for North America, a large data gap corresponds to the Central Plains. According to Grimm (2001:51), the history of the vegetation for much of the Great Plains region up until now has been intangible due to the fact that there is a shortage of suitable sites for pollen analyses. Although playa lakes are common in parts of the Great Plains, the dry conditions of playa lakes in the Great Plains inhibit the preservation of pollen (Grimm 2001:51). According to Johnson and Willey (2000:89), little is known about the environmental change in the Central Great Plains during the transition from the Pleistocene to the Holocene because very few sites in the region are conducive to pollen preservation. What is known comes from proxy measures such as geomorphic records and faunal and floral remains.

Some paleoenvironmental information does exist for regions adjacent to the Central Plains. At Bull Creek, in the panhandle of Oklahoma, paleoenvironmental indicators such as pollen, phytoliths, and stable-carbon isotopes indicate that, at approximately 11,000 RCYBP (the beginning of the Younger Dryas), the climate shifted to drier and cooler conditions and then fluctuated between cooler and warmer conditions until the beginning of the Holocene when warmer conditions were dominant (Bement et al. 2007; Bement and Carter 2008). During the Younger Dryas, at the Folsom site in New Mexico, in the lower level of the site, almost a dozen species of snails were found in the Paleoindian bone-bed. Oxygen isotopes values determined on these snails reveal lower summer temperatures by several degrees (Balakrishnan et al. 2005; Meltzer 2006). On the Southern High Plains, stable-carbon isotope and microvertebrate data (Johnson 1986, 1987a, b; Holliday 1995, 2000) were collected along draws in the Brazos and Colorado River basins. These data imply a drying and warming trend through and after the Younger Dryas (Holliday et al. 2011). On the Southern High Plains in eastern New Mexico, at the San Jon Playa, phytolith assemblages and stable carbon isotope values determined on soil organic matter also indicate a warming and possible drying throughout the Younger Dryas (Holliday et al. 2008, 2011). At the Aubrey site, on the Southern Prairie Plains in north central Texas, paleoenvironmental data from pedogenic carbonate implies a shift toward lighter values of $\delta^{13}C$ at the beginning of the Younger Dryas, which indicates a shift towards cool season grasses (Humphrey and Ferring 1994). Immediately after the Younger Dryas episode, the isotopes at the Aubrey site shift toward heaver $\delta^{13}C$ values, which implies a shift to more warm season grasses. Cordova et al. (2010) examined environmental change in the late Quaternary by using phytoliths and other soil-related proxies in the Central and Southern Great Plains. The $\delta^{13}C$ values determined on soil organic matter and the opal phytolith assemblages revealed that areas dominated today by C_4 grasses were dominated by woody plants and C_3 grasses before 10,000 ^{14}C yr B.P.

In their study of the stratigraphy and paleoenvironments of the Younger Dryas episode in the Great Plains, Holliday et al. (2011:520) conclude that "the various geomorphic systems of the Great Plains did not behave synchronously in response to any common climate driver. These stratigraphic records reflect local environmental conditions and probably a complex response to the reorganization of mid-latitude climates in the terminal Pleistocene and early Holocene." Thus, reconstruction of the climate in the Great Plains during the Younger Dryas episode relies on proxy measures (e.g., soil and sediment data and stable carbon isotope analysis) and does not rely on pollen.

Though the boundaries of the modern ecoregions are used as a proxy for the Folsom time period in the Central Plains, the specific characteristics of the modern ecoregions have certainly changed since the Younger Dryas episode. For example, the characteristics of the Western High Plains ecoregion in Nebraska during the Younger Dryas would have been colder and would have had more C_3 grasses (or moist-season adapted plants) than today based on stable carbon isotope ratios of soil organic matter (Johnson and Willey 2000). The area probably had significantly more active playas and more effective moisture. Continued development of proxy measures of the paleoenvironment and vegetation during the Younger Dryas episode (such as stable carbon isotope analysis of soil/sediment) should help ascertain more specific characteristics of the modern ecoregions during Folsom time.

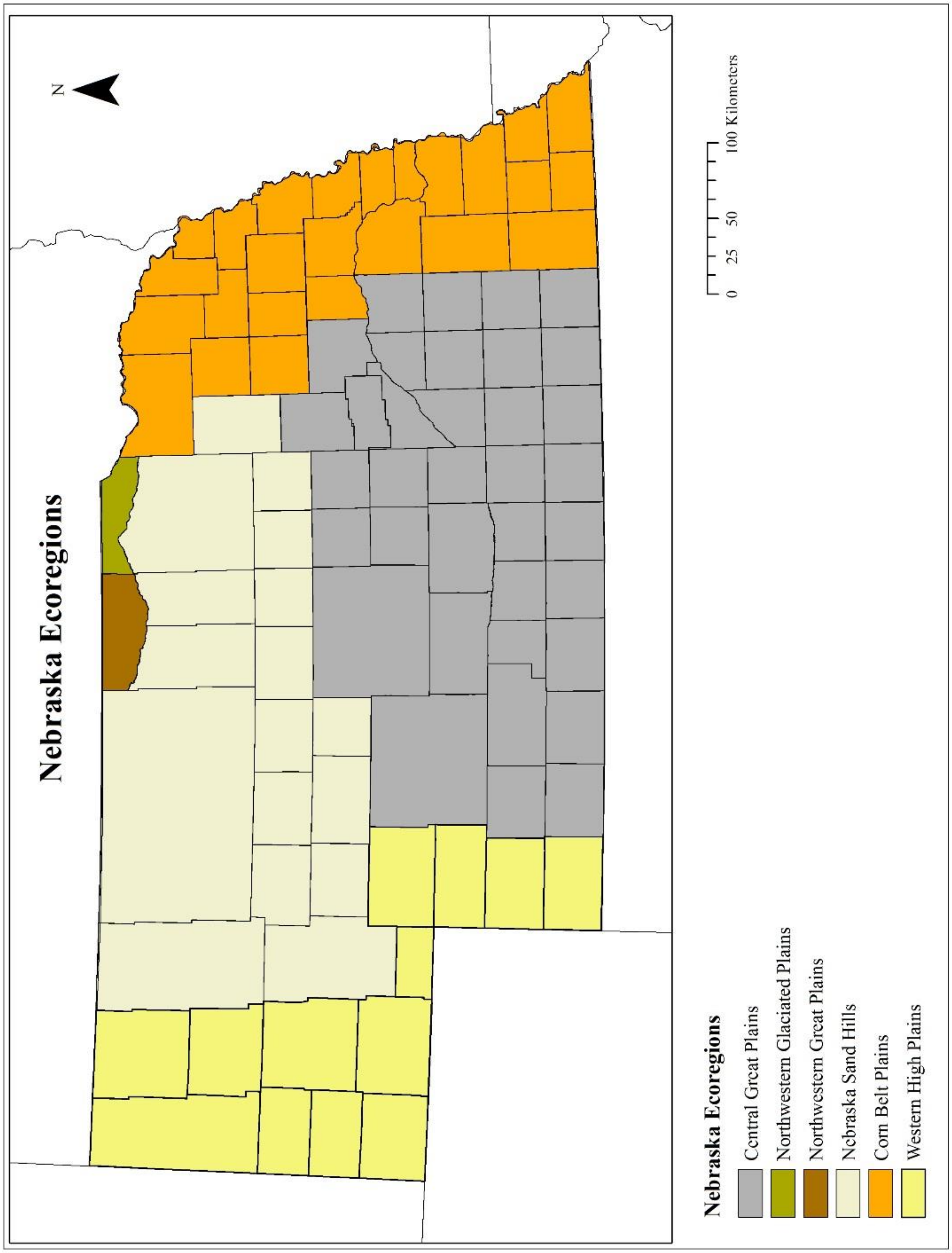

Figure 1.1: Ecoregions of Nebraska

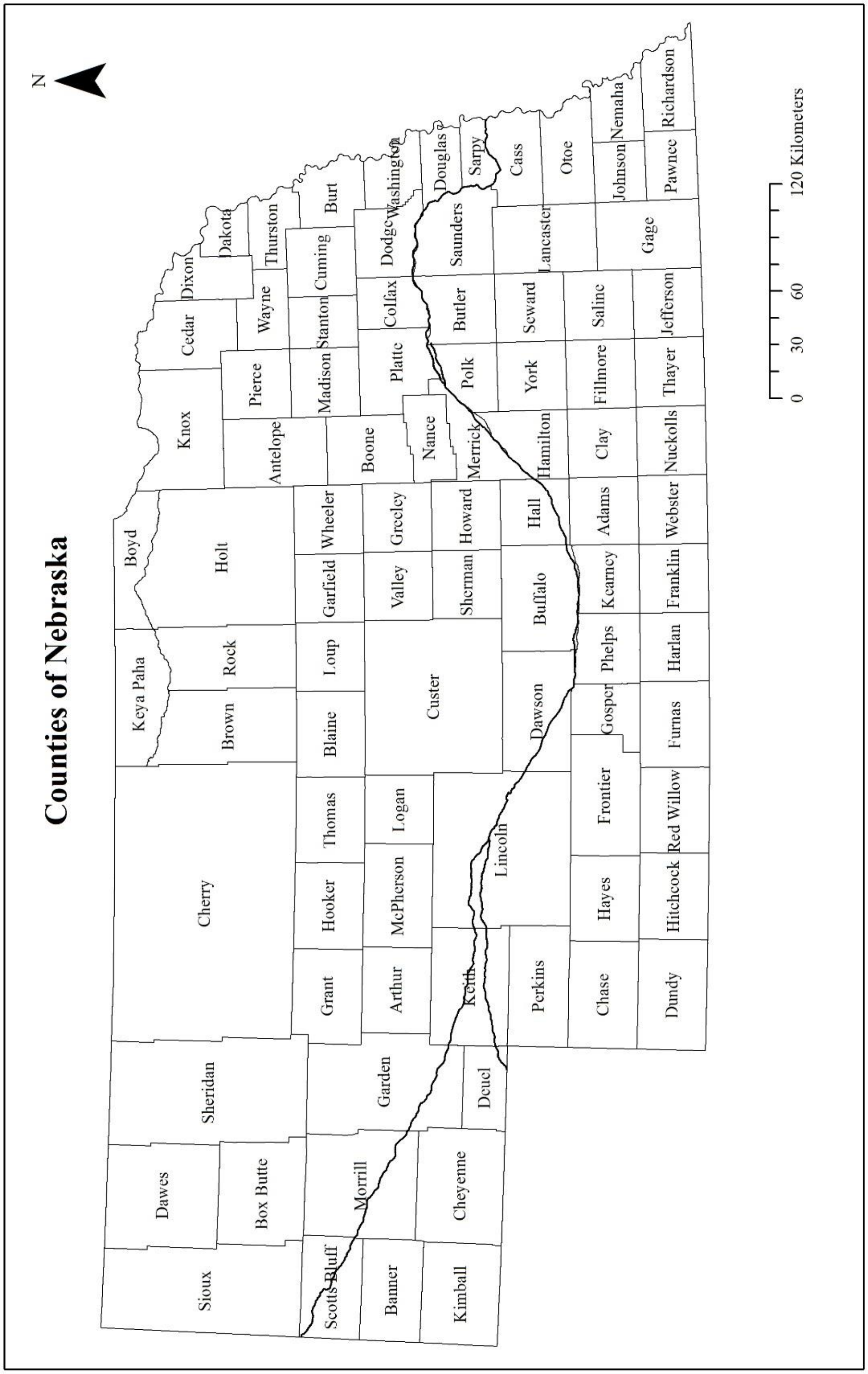

Figure 1.2: Names of Nebraska Counties

Table 1.1: Assignment of Counties to Ecoregions

County	Central Great Plains	Nebraska Sand Hills	Northwestern Glaciated Plains	Northwestern Great Plains	Corn Belt Plains	Western High Plains
Adams	XX					
Antelope		XX				
Arthur		XX				
Banner						XX
Blaine		XX				
Boone	XX					
Box Butte						XX
Boyd			XX			
Brown		XX				
Buffalo	XX					
Burt					XX	
Butler	XX					
Cass					XX	
Cedar					XX	
Chase						XX
Cherry		XX				
Cheyenne						XX
Clay	XX					
Colfax					XX	
Cuming					XX	
Custer	XX					
Dakota					XX	
Dawes						XX
Dawson	XX					
Deuel						XX
Dixon					XX	
Dodge					XX	
Douglas					XX	
Dundy						XX
Fillmore	XX					
Franklin	XX					
Frontier	XX					
Furnas	XX					
Gage					XX	
Garden		XX				
Garfield		XX				
Gosper	XX					
Grant		XX				
Greeley	XX					
Hall	XX					

County	Central Great Plains	Nebraska Sand Hills	Northwestern Glaciated Plains	Northwestern Great Plains	Corn Belt Plains	Western High Plains
Hamilton	XX					
Harlan	XX					
Hayes	XX					
Hitchcock	XX					
Holt		XX				
Hooker		XX				
Howard	XX					
Jefferson	XX					
Johnson					XX	
Kearney	XX					
Keith						XX
Keya Paha				XX		
Kimball						XX
Knox					XX	
Lancaster					XX	
Lincoln	XX					
Logan		XX				
Loup		XX				
Madison					XX	
McPherson		XX				
Merrick	XX					
Morrill						XX
Nance	XX					
Nemaha					XX	
Nuckolls	XX					
Otoe					XX	
Pawnee					XX	
Perkins						XX
Phelps	XX					
Pierce					XX	
Platte	XX					
Polk	XX					
Red Willow	XX					
Richardson					XX	
Rock		XX				
Saline	XX					
Sarpy					XX	
Saunders					XX	
Scotts Bluff						XX
Seward	XX					
Sheridan		XX				
Sherman	XX					
Sioux						XX

County	Central Great Plains	Nebraska Sand Hills	Northwestern Glaciated Plains	Northwestern Great Plains	Corn Belt Plains	Western High Plains
Stanton					XX	
Thayer	XX					
Thomas		XX				
Thurston					XX	
Valley	XX					
Washington					XX	
Wayne					XX	
Webster	XX					
Wheeler		XX				
York	XX					
*Note: XX indicates in which ecoregion the centerpoint of the county fell into. This is the ecoregion in which the county was assigned for analysis						

Chapter 2: Method and Theory for Regional Non-Site Archaeology and Early Paleoindian Period Research

Regional Non-Site Archaeological Theory

Regional archaeology is a theoretical construct advanced by Robert Foley and can be used to explain why archaeological research is hindered if we limit ourselves to the study of only excavated, documented, and well-studied sites. It can also be used to justify the importance and significance of surface artifact datasets that represent extensive areas (e.g. an entire state). Foley (1981a: 1) examines the archaeological record in terms of its regional scale and ecological basis and investigates this scale in terms of its promise for offering spatial information. He constructed a model, based on the assumption that archaeological data are connected to mainly long-standing overall behavioral characteristics, and that ecological theory could be employed to foresee their structure. The model ought to offer a way of obtaining information from extensive scatterings of surface material. Foley (1981a; 1981b; 1981c) presents a theoretical basis for an "off-site" approach to archaeology and an analysis of artifact density on regional scales.

Foley argues that for several reasons the archaeological record is spatially continuous—that is, artifacts occur unremittingly across a landscape—and differ only in terms of their variable density. This is what he refers to as regional archaeological structure and he advocates an off-site approach to utilize this spatial continuity in order to maximize archaeological information (Foley 1981a: 2). Foley establishes that the archaeological record is spatially continuous by showing that the behavior of humans takes place continuously across the landscape. Because the archaeological record is spatially continuous, the "site" may not be the best framework for its analysis and is certainly not the only proper scale. Within archaeology, via the process of artifact discard, it is possible to gain access to information about human behavior. Artifact discard “is a function of the rate of use and the distribution of human activity…” and “…access to prehistoric behavior is further influenced by the fact that human activity is preferentially concentrated at spatial foci” (Foley 1981b: 158). But, not all human activity, and specifically debris-producing activity, adheres to this pattern. Some of the debris-producing activity occurs at locations away from the site or settlement. Therefore, the most straightforward model for initial artifact distribution is a succession of concentrations which grade outward to a dispersed scatter of artifacts.

We can infer that the activities of humans are not only focused at home bases or settlements which could eventually become archaeological sites, but instead human activities are dispersed across landscapes. This occurs at and can be studied at multiple scales (Andrew et al. 2008; Johnson 1977). From this viewpoint settlements or home bases are centers on the landscape where a high-level of human activity occurs, and the distinctions between different sections of the landscape are ones of various degree or intensity of activity of various types. Because of this we may conclude that the behavior of humans is “spatially continuous” (Foley 1981a: 2). Instead of viewing the archaeological record as a scheme of structured sites, we should view it as a continuous pattern of variable artifact densities and distributions (Foley 1981b).

Foley argues that human behavior is not only spatially continuous, but that its structure can be described and understood by looking to ecological theory. Because much of human behavior is related to subsistence strategies, it can be expected that patterns of human behavior and archaeological distribution will correspond with rules of ecological theory that express the association between human populations and their resources. The most relevant concept and analytical device for observing this spatial patterning of human adaptation and behavior is the "home range." He defines the home range as "the area over which an animal normally travels in pursuit of its routine activities," and that the home range simply refers to the area in which resources are exploited (Foley 1981a: 2).

Because human activity is specific to the home range and is spatially continuous, then by way of the processes of artifact use and discard the material expressions of that human activity will also be dispersed continuously. In essence, the artifact distribution and density will be a sign of the configuration of the utilization of resources (Foley 1981a: 3). Therefore, the archaeological record can best be analyzed in terms of an "off-site" (beyond the site) approach that takes into account a regional archaeological structure and discard pattern.

Another important consideration is that of accumulation. The archaeological record is rarely the result of a succinct occurrence of human behavior, but instead is the product of extended buildup of repetitive events. This is particularly true with prehistory on the regional scale where the perceptible archaeological manifestations can singularly be understood under the circumstances of palimpsests of human activities. All of this must be considered in order to assess the archaeological record on the regional scale signified by the patterns of artifact densities. Based on the magnitude of the accumulative process, the extent of the archaeological record scale is conceivably considerably bigger than we have typically thought (Foley 1981a: 12).

Analyzing the variability of regional artifact densities can offer information on the patterned behaviors (adaptations) of prehistoric peoples (Foley 1981a: 14-16). A regional archaeology model attempts to describe the relationship connecting observable archaeological information and prehistoric human activities. Such models also try to assess the relationship between the spatial pattern of subsistence behavior and the structure of the archaeological record. The spatial pattern of human populations can be described, at least partially, by ecological principles. In particular, if we think in terms of the home range, these ecological principles underlie the archaeological record's formation. Given that regional archaeological structure is spatially continuous, it is further affected by geomorphological and other processes that occur post-depositionally. Such processes are exacerbated by accumulation or palimpsests of human behavior all contributing to the ubiquitous distribution of archaeological material which affects not only appropriate analytical scales, but also their interpretation. It is because of these factors, that archaeologists should define the scale of their regions of study as expansively as possible.

As for "off-site" archaeology, few human activities occur exclusively at the settlement, just as few are totally confined outside the settlement. A more accurate way to envision debris- and artifact-producing human activities is that they occur within the home range and that they cluster in parts of that home range. The thickest clusters of debris will usually occur at the settlement, but the settlement won't be the sole cluster occurring within the home range. Gathering places for other activities will occur outside the settlement, such as raw material sources, artifact preparation sites, ceremonial locations, hunting blinds, tree-felling areas, water holes, butchering areas and shade areas (Foley 1981b: 164). Therefore, the traditional focus on sites omits a significant part of archaeological data. Sites represent only a diminutive portion of the possible total archaeological record. The label "off-site archaeology" can be employed for studies involved with the entire regional population of artifacts as opposed to the term "on-site archaeology" which is concerned with only the isolated clusters in it (Foley 1981c: 10). An artifact density study is premised on the thought that the archaeological record is less-confined to sites than has been previously thought and that the continuous nature of archaeological debris across a landscape can be used to investigate regional patterns. Therefore the low density, but spatially continuous archaeological record is very informative and it is much more extensive than a site-based method.

The study of surface artifact evidence is still extremely important even if we have well-excavated, documented, and studied archaeological sites from an area. The theory of “regional archaeology” and the methodology offered in an “off-site” archaeological approach demonstrate that people did not limit themselves to activities carried out only at a site or settlement. Humans performed many activities that occurred “off-site” and therefore archaeological research is hindered if we limit ourselves only to the study of well-excavated sites.

The introduction of Geographic Information Systems (GIS) into archaeological method further enhanced the use of regional archaeological theory and an “off-site” approach. The use of regional archaeological data is no longer relegated to simple graphical and mathematical procedures—now new technologies like GIS can be used to represent and enhance analysis of spatial relationships (Kantner 2008).

Prior Work on Regional-Scale Distribution Studies of Folsom, Clovis, and Paleoindian in the Region

An important prior work on regional-scale distribution studies of Paleoindian include Stanford’s (1999) study of Paleoindian groups (Clovis, Folsom, Goshen, Plainview, Agate Basin, Hell Gap, and Cody) in the Southwest and Plains. This regional-scale study is a synthesis compiled from archaeological sites from the Plains and Southwest regions. As the study demonstrates, the use of site-specific studies compiled on a regional-scale provides a powerful collection of assemblages, radiocarbon dates, and cultural characteristics for each Paleoindian cultural complex in the Plains and Southwest. The limitation of the study is that Paleoindian sites and isolates that are not well-documented are omitted, which means that the evidence for each Paleoindian complex are not based on all (or even most) of the possible materials for complexes (such as Folsom).

Prior work on regional-scale distribution studies of Clovis in the United States includes the work of Prasciunas (2008) who examined Clovis from both a regional-scale perspective and at the site scale. Loebel (2012) also examined Early Paleoindian projectile point distribution on a regional scale. Prasciunas' regional-scale study examined projectile point distribution in 18 United States (Nevada, Utah, Arizona, Wyoming, Colorado, New Mexico, Nebraska, Kansas, Oklahoma, Texas, Arkansas, Mississippi, Tennessee, Alabama, Georgia, Florida, South Carolina, and North Carolina) and whether certain modern factors were biasing the Clovis distribution in this large scale study. Prasciunas concludes that the Clovis distribution in this regional-scale study was significantly predicted by modern population and cultivation, but Clovis distribution had no clear relationship with archaeological research intensity. A limitation of this study is that it does not investigate how geomorphic factors could be potentially biasing the Clovis distribution in the study area.

Similar to Prasciunas, Loebel (2012) examined whether modern factors were biasing fluted point distributions in the upper Midwest (i.e., the western Great Lakes area in Illinois) using a GIS raster based approach. Loebel found that distributions of fluted points in this region were influenced to some degree by modern population density (possibly reflecting greater numbers of artifact collectors in areas with higher population densities), geomorphic factors, and artifact recording. Investigations of whether modern population, modern land use practices, archaeological research intensity, and geomorphic factors bias regional-scale distributions need to be a regular inclusion in such projectile point distribution studies at the regional-scale.

In contrast, Prasciunas (2008) also examines the validity of the “high tech forager” model of Paleoindian land use from a site-scale perspective, using the Sheaman Clovis site located in eastern Wyoming. The “high tech forager” model of Paleoindian land use (as put forward by Kelly and Todd (1988: 237-238)) states that early Paleoindian land use and technology was characterized by a highly mobile technology for a highly mobile people, redundant and short-term land use, a highly curated technology with artifacts made from exotic materials procured from long-distance sources, tools that are reused, reworked, and recycled, raw material conservation, tool life extension was achieved by extensive resharpening, and heavy reliance on a bifacial technology. Prasciunas’ (2008:107) study was able to demonstrate that the Clovis assemblage at the Sheaman site does conform to the “high tech forager” model. This testing of Paleoindian land use was performed from an individual site-level scale.

Prior work on regional-scale distribution studies of Paleoindian in the Great Basin was performed by Jones et al. (2003) who examine lithic source use and foraging territories of Paleoarchaic (11.5-8.0 ka) peoples of the central Great Basin. Their study examines lithic source and technological organization of Paleoarchaic assemblages to make inferences about mobility, possible population movement patterns, and assess the geographic range of material movement. This study of Great Basin groups during the Paleoarchaic is on a large geographic scale and reveals that these groups moved in large subsistence territories spanning larger than 400 km in a north-south direction (paralleling valley and mountain range orientations). By analyzing obsidian sources, Jones et al. (2003) determined the geographic scale of movement for these groups of the Great Basin during the terminal Pleistocene and early Holocene encompassed a large region—the whole length of eastern Nevada and part of western Utah. A limitation of this study is that of determining movement patterns from lithic material sources because the lithic material could have been acquired through trade. The authors incorporated the study of technological organization in addition to lithic source provenance to advance their arguments about the scale of the territories in which Paleoarchaic peoples were moving in the Great Basin.

Previous work on regional-scale distribution studies of Folsom include Andrews et al. (2008) who examined Folsom archaeological variability at multiple scales (the site scale, the foraging scale, and the macro-regional scale). Their site-scale analysis shows a large variability in spatial characteristics between small locales that were perhaps occupied once and large sites with multiple occupations. In their analysis of the Folsom foraging-scale (or the space in which hunter-gatherers forage on a day-to day basis) they found that at this scale Folsom is not well-understood, though ethnographic records and large sites like Lindenmeier can be informative of land use at this scale. Their most powerful arguments come from their macro-scale analysis in which they use a sample of 619 Folsom sites, locales, and isolates from the Southwest, Great Plains, and Rocky Mountains. Andrews et al. (2008) found that the foothills located just outside the High Plains and intermountain basin areas (e.g. the Central Rio Grande Valley of New Mexico; and the San Luis Valley, Middle Park, and Upper Gunnison Basin of Colorado) had the highest frequency of Folsom locales. They attribute this to the foothills and intermountain areas having a resource base that is diverse and these areas have a land use strategy that is more residential (Andrews et al. 2008: 484). They note that Amick (1994) found a similar residential pattern for Folsom in the Basin and Range region of New Mexico. A limitation of Andrews et al.’s study of Folsom at the macro-regional scale, is that most sites at this scale of analysis are not well-documented. But, as the authors point out, most models of Folsom land use are largely drawn from data from a few well-documented sites. A pitfall of this is the models drawn from these few sites do not fully capture the entire spectrum of Folsom behavior (Andrews et al.

2008:483). Other regional-scale distribution studies on the Plains could be compared to this study to see if areas characterized by highly mobile prey (i.e. bison) differ from areas with a diverse and predictable resource base (e.g., plants, small game, lithic raw materials, potable water, wood) in respect to land use strategies.

Another regional-scale distribution study of Paleoindian in the region is Blackmar's (2001) study of the variability in Clovis, Folsom, and Cody land use. Blackmar examined projectile point distributions in Kansas, Texas, and Oklahoma and found variability in land use among these Paloeindian complexes. By investigating land use on a large scale, Blackmar was able to examine four geographic regions—the Prairie Plains, High Plains, Savannah, and Woodlands. Land use for Clovis peoples in these areas was deemed to be independent of geographic region. Folsom land use was "regionally focused" on the Prairie Plains and High Plains regions (Blackmar 2001: 65). Cody land use was found to be strongly linked with the Woodlands region. This study incorporated a region 1,067,067 km^2 in size and contains varied environmental zones (Blackmar 2001: 65). Studies such as Blackmar's can make a compelling case for using regional-scale studies as a complement to site-specific studies as a likely way to test Paleoindian models of mobility, social organization, and economy. As Blackmar points out, a possible bias in her study may be in the form of whether the patterns of land use are actual cultural patterns or could be a result of archaeological sampling or geomorphic landscape history biases (Blackmar 2001: 74). Analyses of Paleoindian land use in neighboring regions can be added and compared to Blackmar's (2001) study of Paleoindian land use in the Southern High Plains, Prairie Plains, Savannah, and Woodlands. This would make for a large piece of real estate in which to evaluate large-scale questions about Paleoindian land use.

Holen's (2001) study of Clovis mobility and lithic procurement in the Central Plains is another regional-scale distribution study in the area. Holen created a regional-scale model of Clovis mobility and adaptation to rapid climate and biotic change during the Pleistocene/Holocene transition in the Central Plains. By studying lithic source evidence, Holen found that some Clovis groups in the Central Plains may have migrated long distances in response to bison movements, while other Clovis groups likely attached themselves to certain "refugia" areas on the High Plains (e.g. the southern portion of the Black Hills)—which were settings with protection and milder winters than higher elevations and the open plains. A limitation of this study, which Holen points out, is that the type of data commonly used in regional-scale studies—projectile points found in non-site surface contexts—may not have been used, lost, and discarded the same as other items in the toolkit (Holen 2001:119). This type of data doesn't tell us about reduction sequences or assemblage composition as the toolkit was transported. However, Holen's study relied on non-site data from private collections—which allowed a regional-scale study of Clovis in the Central Plains. Such a study would not have been possible if the research had been limited to only well-excavated sites—as Clovis data from excavated sites does not exist for the entire state of Nebraska. Using diagnostic Clovis surface finds allowed Holen to fill a large gap in the Clovis data for much of the Central Plains region.

Loebel's (2005) dissertation examined early Paleoindian projectile point distribution in the western Great Lakes area of the upper Midwest and examined the organization of technology, settlement systems, mobility, and lithic material use. He examined long term land use patterns and mobility based on lithic resource use that suggested a large scale of land use for early Paleoindians in the region. He found lithic material movement in south-north and north-south directions with movements of lithic material commonly greater than 250 km, and he estimated a Clovis group annual range of 340–700 km. A possible limitation of this study is that reliance on projectile points may bias it towards hunting activities. Lepper (1988:37) however, argues that Clovis projectile points were multipurpose tools and as such patterns of projectile point distributions may indicate other activities as well as hunting at a regional scale.

An important regional-scale distribution study is Amick's (1994) Folsom land use analysis of the Southern Plains and Southwest. He examines Folsom weaponry artifacts and discerns patterns for comparison of Folsom regional land use strategies in the Southern Plains and Southwest (Amick 1994:386). He uses ratios of projectile point bases to tips and points to preforms as well as inferences of isolated Folsom finds to make his interpretations. The regional differences in these ratios were used to identify variation in Folsom settlement and land use strategies. Some regions had low projectile point to preform ratios and high projectile point base to tip ratios which are thought to indicate a more residential land use strategy under more reduced mobility. Other regions had high projectile point to preform ratios and low projectile point base to tip ratios which is thought to indicate a Folsom land use strategy with an emphasis on hunting and high logistical mobility (Amick 1996:416-417). He found a significant difference between the High Plains and intermontane basin regions of the Rio Grande Valley in terms of proportions of preforms to finished points. The High Plains had fewer preforms than the Basin and Range areas of the Southwest. Amick concludes that in the Southern High Plains Folsom land use patterns follow a more logistical land use strategy, while in the Basin and Range of New Mexico it was characterized by a more residential land use strategy (Amick 1994: 426). The large number of isolated Folsom finds in the Basin and Range is interpreted as a dependence on encounter hunting in this area. A limitation of Amick's study is that because his analysis relies on weaponry artifacts, the interpretations could be biased towards hunting activities.

As Amick (1998:8) points out, regional comparisons are often lacking in Folsom studies and such studies of "Folsom lifeways…are often assumed to be the same in all regions." New regional-scale Folsom land use studies can be used to compare Folsom land use to prior large-scale Folsom studies in the High Plains, Prairie Plains, Savannah, and Woodlands (Blackmar 2001), the Southern Plains and Southwest (Amick 1994), the Southwest, Great Plains, and Rocky Mountains (Andrews et al. 2008), and the Plains and Southwest of North America (Stanford 1999). In addition, new regional-scale studies of Folsom land use can be used as a comparison of Clovis versus Folsom distributions in the Central Plains using Holen's (2001) study of Clovis in the Central Plains.

Land use can be examined from many scales—whether at the site scale, or at the regional scale. The types of questions asked at the regional-scale are sometimes different, but can be the same as those asked at the site-level scale. Both scales are important, one is not better than the other and each scale has its own set of limitations (Sellet 2006:223). These limitations need to be recognized and investigated in land use studies performed at both the site and regional scales. The discernment of regional patterns from projectile point distribution studies is a valid avenue of research, particularly in regions where there are few or no well-excavated sites. Indeed, one can argue that even in areas where excavated and well-studied sites exist, that the combined use of site-level data and regional-scale distribution studies provides a more robust level of analysis that is more powerful than either scale alone can provide.

Defining Space and Scale for Folsom Study in the Central Plains and the Scales of Land Use of Mobile Hunters

The Central Plains Folsom dataset encompasses a large geographic region, including the entire state of Nebraska and lithic source areas outside the state. This provides an appropriate geographic scale to address large-scale regional land use strategies because it contains a broad diversity of physiographic regions (or ecoregions) and resources. The state of Nebraska covers an area of 200,282 km^2. However, land use by Folsom peoples was not restricted by state boundaries; their economic territories overlapped in various ways with Nebraska as indicated by commonly used lithic source areas which occur outside the state (i.e., White River Group silicates in southeastern Wyoming, northeastern Colorado, and southwestern South Dakota; Smoky Hill Jasper in northern Kansas; and Hartville Uplift chert in east-central Wyoming). So this study of Folsom in the Central Plains includes the well-represented lithic source areas outside of Nebraska.

In the now classic ethnoarchaeological study of the Nunamiut Eskimo in Alaska, Binford (1983a, 1983b) found that the scale which archaeologists normally perceived of the land use of mobile hunter-gatherers was not only incorrect, it was laughable. Binford reported the spatial scale used by one group of Nunamiut for one year and then demonstrated that over the course of a lifetime this can add up to a huge amount of space, and therefore the land use of mobile hunter-gatherers is very large. Over the course of a year, one group of Nunamiut have an area in which they establish base camps/settlements (Binford terms this the "residential core area") that covers an area 5,400 km^2 in size. If the trips out from base camps/settlements are counted it includes an area of 25,000 km^2. He reports that one family of G/wi Bushman can also occupy a similar residential core area over the course of about a year, hence the Nunamiut are not unique among mobile hunter-gatherers (Binford 1983b:110). Five Nunamiut families can have a residential core area that is about as large as the French Dordogne region over the course of five years (Binford 1983b:112). In other words, mobile hunter-gatherers have a scale of land use that is much larger than archaeologists are accustomed to considering.

The enormous spatial scale of land used by mobile hunter-gatherers is demonstrated when Binford describes the vast amount of space that a typical Nunamiut male uses during his lifetime (Binford 1983a, 1983b). The long term land use cycle for the Nunamiut is the land used over the period of a hunter's lifetime (Binford 1983b:114). The land used shifts in a cycle, where a certain territory is used for about 6–10 years, after which the environment becomes depleted (in terms of animals and firewood) and becomes filled with vermin, hence the group will move to a different territory (Binford 1983a:38; Binford 1983b). Among the Nunamiut, the typical male resides in 5 different territories over the course of his lifetime which covers an area that is 22,000 km^2. However, the typical Nunamiut male will travel over 300,000 km^2 over his lifetime while hunting for animals (Binford 1983b:115). According to Binford, this is the amount of space, the large scale of lifetime land use, that archaeologists must think about if we want to understand mobile hunter-gatherers' archaeological site variability (Binford 1983b:117). This demonstrates that mobile hunter-gatherers are capable of using a vast amount of space, making the scale of land use of a group of hunter-gatherers very large over the period of a lifetime.

Understanding hunter-gatherer landscape use involves understanding that individual archaeological sites are part of an overall land use system and settlement pattern. Hunter-gatherers settlement and land use patterns can be analyzed at multiple scales—the huge area used by one hunter over the course of a lifetime (lifetime land use on a regional scale), the residential core area scale (the area encompassing settlements/base camps), the site complex scale (a group of sites that are interconnected—for instance in the hunting of bison—the kill/butchery site, the hunting camp, etc.), the single site-level scale, and the activity-level scale (Binford 1983b:142). If we want to understand long term patterns of land use of mobile hunter-gatherers, we must perform archaeological analyses at all scales—including the site-level and regional-level scales.

Amick's (1996) regional-scale study in the Southwest suggests an estimate for Folsom land use and mobility that exceeds that of even the highly mobile Nunamiut (Binford 1983a). Amick derives this from estimating a seasonal round where Folsom hunters geared up at Edwards chert and exploited the Southern Plains and then returned to the Tularosa Basin (thus Edwards chert was transported 700 km at the very minimum in order to reach this intermontane basin of the Rio Grande Valley)—making the estimated annual distance 1,400 km. To put this into perspective the total annual distance figure for the Nunamiut is 725 km per year (Binford 1983a: Table 1). Amick suggests that the wide distribution pattern of Edwards chert suggests a Folsom land use strategy on the Southern Plains of gearing up at lithic material sources and manufacturing Folsom weaponry before heading out onto the Southern Plains. The wide Edwards chert distribution pattern in this region suggests Folsom hunters may have operated in territories of 120,000 km^2 in the Southern Plains region (Amick 1996: 415).

Amick uses Binford's figures on Nunamiut land use and population densities as potential parameter constraints for highly mobile hunters. Amick notes that the total area used by the Nunamiut per year is 63,700 km^2, and estimates that the total area used by Folsom per year in the Southwest is between 90,402 − 135,603 km^2 (this is approximately one-third the size of the entire state of New Mexico). If Amick's minimum estimated mobility and annual ranges are correct, this would make the scale of Folsom land use larger than any recorded for modern hunter-gatherers, including the Nunamiut.

Amick's estimates suggest an expansive land use pattern for Folsom—and that Folsom groups in the Southwest and the Southern Plains may have used several intermontane basins in the course of one year (Amick 1996:419). Amick estimates that based on lithic material evidence, Folsom groups in the Southwest may have had an annual range between two and three times the size of the annual range reported for the Nunamiut (Binford 1991:Table 12). Amick hypothesizes that the enormous scale of land use for Folsom could have been because of their low population densities and that they were specialized hunters of bison. A limitation of this study, and that of most regional-scale studies that rely on projectile point data, is that the inferences could be biased towards hunting activities (Amick 1994). Thus, stone tools that would be indicative of other activities such as the processing of food, and hide and wood working are captured with this type of lithic data (Sellet 2006:224).

If Amick's (1996) estimates for the scale of Folsom land use in the Southern Plains and the intermontane Basin and Range along the Rio Grande of the Southwest are correct, it raises the question whether Folsom groups in other areas are operating at a scale of land use even larger than the Nunamiut? Do Folsom groups, in general have a scale of land use larger than that recorded for modern hunter-gatherers? For Folsom hunters, was hunting mobile prey, such as *Bison antiquus* pushing the limits of the scale of hunter-gatherer mobility normally envisioned, based on what we know about modern hunter-gatherers?

Another model addresses technological gearing up, but instead of a regional analysis, Sellet's (2013) analysis is performed at the site-level. Sellet (2013) created a model for measuring anticipated mobility, as measured by "gearing up." His study contrasts two different strategies in which Folsom hunters might manufacture their projectile points. One strategy is replacement or retooling (manufacturing new points to replace those that are worn out, lost, or broken) and a second strategy of "gearing up" (where points were produced in quantities, in preparation for a future hunt). When Folsom hunters were gearing up, the archaeological signature should show an imbalance in the number of manufactured points versus the number of discarded points. This can be contrasted with the strategy of replacement or retooling where the ratio of preforms and channel flakes to broken and discarded points should be approximately one to one. Sellet used two different scales of analysis for his study. First, he performs a large-scale analysis considering ratios of manufactured points to discarded ones for many Folsom campsites, with the results indicating that at the majority of Folsom sites, the strategy of replacement or retooling was used (the ratio was about one to one, or an equal proportion of broken and discarded point to preforms and channel flakes).

Sellet (2013) then shifts the scale of analysis to the site-level and examines gearing up and anticipated mobility from the perspective of a single site—the Lindenmeier site. He found a difference in projectile point production between Areas I and II at Lindenmeier. Whereas Lindenmeier Area I showed a strategy of raw material conservation (only a portion of lost or worn out points were replaced), at Lindenmeier Area II, a gearing up strategy was seen, where points were manufactured in excess of immediate needs (where there is a lot of preforms and channel flakes in relation to discarded points). The distinct behavior patterns defined by Sellet at the Lindenmeier site show that the same people could perform different strategies for projectile point production at one site. Although the analysis at Lindenmeier was from the site-scale perspective, the implications are regional in that it reaches beyond the site for explaining variation between sites and amongst sites. A limitation of this study is that because many Folsom sites do not have large-scale excavations, a gearing up strategy may be difficult to detect at many Folsom sites given the small areas sampled at most sites (Sellet 2013:386).

Sellet's (2013) model for anticipated mobility holds important implications, one being that the archaeological signatures of retooling versus gearing up could be used to identify places where Folsom hunters were camping longer (possibly closer to lithic source areas) and manufacturing hunting equipment when they were gearing up to hunt elsewhere. This contrasts with places where they were hunting and maintaining hunting equipment. One way to measure this (identify hunting versus habitation sites) is to determine the ratios of preforms and channel flakes to discarded points (lost, worn out, or broken).

Another study of technological organization at the site-scale is Sellet's (2006) investigation at the Hell Gap site. Sellet used a nodule method to identify nodules from which a single artifact was made versus nodules that were used to make multiple items. From this he was able to determine whether sidescrapers, gravers, and endscrapers found at the Hell Gap site were transported versus expediently-made. Interestingly, endscrapers were found to have been transported to the site while gravers were often expediently made on-site. Sidescrapers were found to have been expediently made on-site as well as transported to the site. Sellet demonstrated that correlating exotic raw lithic material with transported tools and thus with the mobility of individuals, and likewise, correlating tools made of local lithic material as being expediently made and not transported—does not work. For instance, if a graver is made from a biface made of exotic material, the graver could have been expediently made on-site, but was not transported and thus could not be correlated with the mobility of humans; and as in the case of the Hell Gap site, endscrapers were made of a material that was local to the site, however they had not been made on-site, but instead were transported (Sellet 2006: 228). Sellet's (2006) study illuminates the complexity of deducing patterns of mobility from lithic tools and advocates for a systemic approach to revealing the interactions between strategies of mobility and the possible technological responses to these.

The limitations of Sellet's (2006) study is that studies of technological organization performed at the site-level scale confront difficulties with recognizing the time and space in which lithic activities are conducted. Sellet points out that technological organization studies at the site level have the problem of identifying results from continually changing processes such as the scheduling of lithic use activities on tools which are “static objects” (Sellet 2006:225). This study has important implications for archaeological studies that infer mobility patterns from stone tools. Although this study was performed at the site-scale level, it reaches beyond the site in its implications for Paleoindian mobility and settlement-subsistence systems and inferring mobility from stone tools—this may typically be more complex than we think. We need better models for inferences about mobility from lithic tools than simple correlations of local material with expediently made tools and exotic lithic materials with transported tools.

Hofman’s (2003) study has regional patterning implications for Folsom artifact distributions. Its focus is mostly on an individual site, the Nolan site, which is located in western Nebraska in Chase County. But, the patterns seen in the Folsom artifacts at the site hold regional implications for long term land use patterns. The strong pattern in Folsom lithic material movement is of White River Group Silicates being moved from the Flattop Butte source area east and southeast into northeastern Colorado, southwestern Nebraska, and the Nolan site. This contrasts with Smoky Hill Jasper. The source of this lithic material is also located in the vicinity of the Nolan site and southwestern Nebraska, and was only rarely moved westward from primary sources in the Saline and Republican River Basins. Hofman interprets this as repeated movements of Folsom groups from lithic source areas to areas where they would hunt bison. These repeated movements are interpreted to reflect redundant and long term land use patterns in the region. Hofman’s (2003) study provides an argument that studies performed at the site-level, in combination with a regional-scale approach, can often be more powerful than using only one scale or the other. The limitations of such a study, because it incorporates both the individual site scale and the regional scale, is then subject to the limitations of both, particularly with reference to the context and association of artifacts. Future work should explore whether the long term land use patterns of logistical movement from specific lithic sources hold true for the remaining portions of Nebraska. Are they repeatedly going out and hunting and then coming back to certain sources as was the case in Hofman's (2003) study? His study showed a strong pattern where Folsom hunters were repeatedly carrying White River Group Silicates eastward from the source into northeastern Colorado and southwestern Nebraska, while Smoky Hill Jasper was only moved west from the source area a small percent of the time.

By focusing on two Folsom sites in the Southern Plains, the Folsom site and Lipscomb sites, in comparison with other sites in the Southern and Great Plains (Waugh, Lake Theo, Cooper L, Mill Iron, Lipscomb, Casper, Plainview, and Olsen-Chubbock), Hofman's (1999) study combines using the site-level scale from a series of excavated sites in a large region. His study questions the traditional correlations of the proportions of projectile point fragment types with site type. For instance, the notion that kill sites are expected to contain mostly projectile point tips and complete points, while retooling sites and camps are traditionally thought to yield mostly projectile point bases. Counter to the traditional thinking, forty percent of the projectile points found in both the Lipscomb and Folsom site bonebeds were base fragments—which would typically be thought of a pattern that occurs at camp sites—not at kills (Hofman 1999a:128). In other words, the number of projectile point bases should not automatically be thought of as representing a camp as opposed to a kill.

Hofman's (1999) study showed that projectile point fragment type proportions in bonebeds are driven by occupation duration, season of kill, dispersal of carcasses, and lithic material stress. A limitation of this study is that because of the limited extent of most archaeological site excavations, it may be difficult to accurately assess the true proportions of projectile point fragment types at particular sites. This study could be applied to land use studies at the regional-scale using an off-site approach, as an important warning that a large proportion of projectile point bases in a region does not automatically imply a camp site as opposed to a kill, or that a large proportion of bases in a region implies a residential land use strategy as opposed to a logistical one.

Except for a few places, Folsom points are usually lightly distributed across most landscapes—necessitating the integration of Folsom collections of avocational archaeologists with traditional site studies. A study which incorporates the use of avocational archaeological collections in combination with excavated sites for a regional perspective on Folsom is Hofman's (1992a) analysis of Folsom point variability in the Southern Plains. The Shifting Sands site is located in a dune field and artifacts exposed by deflations in the site's blowouts were collected and recorded over a number of years by an avocational archaeologist, Richard Rose. Hofman's (1992a) study primarily uses three Southern Plains Folsom sites (Lipscomb, Shifting Sands, and Cedar Creek) in conjunction with other sites in the Southern Plains to explain the variability seen in Folsom projectile points. A "retooling index" was devised to measure the relative amount of retooling since the last visit to a lithic quarry. For each site, the frequency of Folsom projectile point tips with evidence for reworking or resharpening was plotted against the mean length of points to calculate the retooling index for the following sites: Shifting Sands, Folsom, Lipscomb, Cedar Creek, Lubbock, Blackwater, and Elida (Figure 6.9, Hofman 1992a:213). This study explains variation in Folsom technology and mobility from a pattern recognition study performed from a regional perspective. A further refinement of pattern recognition studies utilizing information about projectile points to interpret variation in Folsom technology and mobility from a regional-scale are needed.

Ingbar and Hofman's (1999) study was performed from the individual site scale, at the Lipscomb site, with implications for Folsom at the regional-scale. They discuss lithic material procurement, Folsom technological organization, mobility, gearing up, and variability within Folsom assemblages. One of their observations is that frequently there is a considerable distance between the place where projectile points were produced and the lithic material sources. This is evidenced by manufacturing failures and preforms being recovered at considerable distances from the material source (Ingbar and Hofman 1999:106). They argue that under a model of economy, one would expect Folsom groups to gear up at the source of materials, and therefore, one should see the complete sequences of the production of fluted points at these quarry locations. Gearing up at the quarry location would be expected as it reduces the expense of the abortion of a preform when at a place where lithic material is unavailable. A new preform of chosen type can be produced at all times when at the lithic material source, but when away from the material source another preform cannot always be produced. Ingbar and Hofman (1999) point out that this scenario is seen at the Adair-Steadman site (Tunnell 1977), but, not at some other Folsom sites—the Lipscomb site included. According to Craig (1983), Frison and Stanford (1982), and Sellet (2004), for the channel flakes recovered at the Agate Basin site Folsom component more than half are made from one nonlocal lithic source—Knife River Flint. A study of the Main Folsom component at the Agate Basin site shows that the preference of lithic raw material is a response to conditions other than distance to raw material sources (Sellet 2004:1562). Also, at the Shifting Sands site, a broad array of channel flakes and preforms were recovered, with all of the channel flakes being made of nonlocal lithic material (Hofman et al. 1990). Therefore, quite the opposite to the assumptions of economizing models, it appears that most of the final stage of production of Folsom fluted points did not happen at or even near the lithic raw material sources (Ingbar and Hofman 1999:102).

Ingbar and Hofman's (1999) and Sellet's (2004) studies underscore the importance of incorporating the study of Folsom technological organization into Folsom mobility and land use studies. Like Sellet (2004), Ingbar and Hofman (1999) also concluded that there was often a discrepancy between the place where projectile points were produced and the lithic material source—as evidenced by manufacturing failures and preforms being recovered at considerable distances from the source of the material—and that this is the case for a number of Folsom sites. Both Ingbar and Hofman's (1999) and Sellet's (2004) analyses were performed at the site-level scale, but both have implications that reach beyond the site to the regional-scale. Limitations of Ingbar and Hofman's (1999) and Sellet's (2004) studies are the weakness that plague all technological organization studies performed at the scale of the site-level—which is that it can be difficult to identify how lithic activities were scheduled from stone tools (see Sellet 2004:225). For mobility and land use studies, it is important to incorporate the study of technological organization, rather than simple distance to source calculations in lithic studies. When possible, it is important to determine frequencies of preforms and proximal channel flakes and determine the percentages of these artifacts that were made from local versus nonlocal material—to determine if the projectile points were produced at or near the raw material source, or if—as is the case for a number of Folsom sites—the projectile points were produced far away from the raw material source, presumably as need demanded.

Projectile Point-Based Studies: Limitations and Possibilities

Large, regional-scale studies often rely mainly or exclusively on projectile points, which serve as temporal markers, in order to gain chronological control over the large number of sites needed in such large-scale analyses (Sellet 2006:223). As such, it is important to discuss the limitations of using projectile point data for any regional analysis that is primarily a projectile point study.

One argument on the limitations of projectile point studies is Bamforth's (2002; 2009). He argues that projectile points differ from other tool classes in terms of the raw materials used. According to Bamforth, tool classes other than projectile points are often made primarily from local raw materials; versus projectile points, which are often constructed of exotic materials. Thus, analyses that rely on projectile points provide a skewed perspective on the mobility of landscape use of Folsom and later Paleoindian peoples. Also, based on his analysis of caches, Bamforth (2009) challenges the assumption that exotic materials were in large part directly procured and therefore challenges the view of Paleoindians as highly mobile. A possible limitation of Bamforth's argument is that part of his argument is based on archaeological data from Lake Theo (located near a lithic material source of Tecovas jasper), the Medicine Creek sites of Lime Creek, Red Smoke, and Allen (located near sources of Smoky Hill Jasper), and sites located near the Knife River Flint source area (the Big Black and Bobtail Wolf sites) (Bamforth 2002:70-71; Bamforth 2009:153, 147). A possible limitation of this arguement could be that because these sites are located at or very near lithic material sources, many archaeologists would expect the projectile point and non-projectile point tool assemblages to look different at a source of lithic material versus a site located a considerable distance from a lithic material source. Bamforth's alternate viewpoint about projectile points being different in terms of raw material than other tool classes, and thus studies that rely on projectile point data skew archaeologists' perception of the mobility and ranges of Paleoindians as highly mobile, must be taken into account in projectile point studies.

Others have also shed light on the limitations of projectile point studies. Sellet (2006:223) describes regional-scale analyses as using a large number of sites, with the intent of seeing patterned behaviors, and at such a scale, the settings of specific site "idiosyncrasies" will disappear. As mentioned earlier, regional-scale analyses often rely on projectile point data in order to control for site function and chronology (Sellet 2006:223). Sellet (2006) presents an argument that projectile points represent a specific piece of lithic systems and they differ from other tools in terms of their replacement and manufacturing. Because of the elaborate ways in which they were hafted, it is possible that projectile points spent more time in the overall lithic system than other tools. Some studies (e.g., Bamforth 2009) have pointed to the prominent role that projectile points have played in Paleoindian studies and have asked for a more equal treatment of other tool classes with this research arena. While Sellet (2013:384) agrees with the need to study other aspects of Paleoindian technology, he points to the validity of projectile point studies which are instilled with "behaviorally orientated questions." Projectile points represent a food extraction function of lithic technology and therefore can give insights into broader aspects of subsistence strategies. Sellet (2013:384) also gives credibility to projectile point studies that assist in understanding the organization of strategies that are weaponry-related (e.g., Amick 1996; Hofman 1999a) and how these have improved our knowledge of the variability found in archaeological data.

Ethical Issues with Using Private Collections for Research

The majority of this study is based on private collections and studies which use or rely on data from private archaeological collections should address the ethical issues with using private collections for research. Archaeological ethics have now become a standard class in many anthropological archaeology degree programs (Science and Technology: Can You Dig It? Ethics and Archaeology 2002). Many archaeological societies, including the Society for American Archaeology, the leading archaeological society in the Americas, have adopted ethical statements to outline appropriate behavior for their members (Lynott and Wylie 1995). When artifacts are in private collections and not under the control of the public domain, this leaves open the possibility that the artifacts can be bought or sold. Some artifacts can bring high prices and provide monetary incentive for buying and selling. The buying and selling of artifacts creates an incentive for looting archaeological sites to obtain artifacts, thus destroying or desecrating sites and the potential to learn about them. When an artifact is bought or sold, the contextual information about the artifact's location and finder is oftentimes lost, and this decreases the value of the artifact for archaeological research. "To avoid appearing unscientific or complicit with the activities of looters, many archaeologists choose deliberately to ignore data from objects in private collections—whatever their significance" (Science and Technology: Can You Dig It? Ethics and Archaeology 2002: 70).

Other concerns in using artifacts in private collections for research pertain to access of the collection to other researchers for future evaluation of study results. Artifacts in private collections can be difficult for researchers to access at all times, as opposed to collections in museums which are generally available for study (Hofman 1992b).

Another ethical concern with using private collections is the issue of avocational archaeologists' recordkeeping. It should be noted here that I am defining "avocational archaeologists" as individuals with some understanding that context is important and they may even be supportive of archaeological education and research. Avocational archaeologists are different from "relic collectors" whose primary goal is to collect artifacts as objects without necessarily knowing or caring where an artifact was found. Relic collectors commonly may engage in buying, selling, and/or trading objects indiscriminately or for profit. Some archaeologists criticize avocational archaeologists' recordkeeping, however, the quality of recordkeeping of professional archaeologists (not long ago) was sometimes questionable before modern archaeological standards of excavation and recording. Standard archaeological procedures are the byproduct of the times and each archaeological generation views the previous generation of archaeologists as archaic in their recording and excavation procedures (Science and Technology: Can You Dig It? Ethics and Archaeology 2002). Some of the issues evident in private collections are also found in public collections acquired by professionals. Professional archaeologists and public institutions are not immune from ethical scrutiny as many artifacts in museums and institutional collections were originally collected by people as souvenirs during their world travels in past centuries. Thus, although some professionals criticize the recordkeeping of avocationals, professional archaeologists prior to modern archaeological standards could likewise be criticized for their record keeping, and this is particularly true for surface found artifacts.

Some avocational archaeologists who amass private collections in fact take more notes, make maps, and in general have better recordkeeping than archaeologists amassing collections for public institutions and museums prior to modern archaeological standards. The relationship between professional archaeologists and avocational archaeologists are starting to change (Science and Technology: Can You Dig It? Ethics and Archaeology 2002:71). Some amateur groups (e.g., The Diggers who investigated battlefields in Belgium) will even seek professional backing—working with a museum, other professional institutions, or in conjunction with archaeological commissions. Although ethical issues arise when using private collections, some of these same issues apply to public collections. One must consider all the issues before deciding to include or exclude private collections for archaeological research. This is commonly a decision which is made on a case by case basis.

The Importance of Private Archaeological Collections

People who collect artifacts can do so responsibly and private archaeological collections should be recognized as a potentially important resource when doing archaeological research. Collections made by private individuals can be of value if the individuals are responsible in their recordkeeping and curation of the artifacts (Hofman 1992b). Some archaeologists refuse to use private collections in their research, which implies that these collections have no value.

People, including Native Americans, have collected artifacts for hundreds of years. Hofman (1992b) reports that Kirk points from the Early Archaic were found associated with burials of Mississippian age stone box graves and historic Native Americans sometimes placed prehistoric projectile points in their sacred bundles. The collecting of artifacts has happened in the past and will continue to go on in the future. Thus, an argument can be made that it is the responsibility of archaeologists to document artifacts in private collections.

It is important to distinguish between the buying and selling of artifacts to make money, (as is done by some relic collectors), and collecting artifacts because one is interested in learning about the past (which is what avocational archaeologists do). “Individuals who have a primary interest in how much an artifact is worth or how much they can make from selling artifacts are not avocational archaeologists and do a considerable disservice to the potential of others to learn about the past” (Hofman 1992b). The knowledge that can be obtained about an artifact is largely dependent on the context in which the artifact was found. When the contextual information about an artifact is lost or separated from the artifact, as commonly happens when it is bought or sold, it has little research value, though it may still have high monetary value (Hofman 1992b).

Avocational archaeologists with collections who practice responsible curation and recordkeeping can help to preserve the archaeological record. It is only through working with avocationals that professional archaeologists can help document important information in private collections and help educate avocationals in stewardship of the past.

Responsible avocational archaeologists with collections tend to keep records of the location and context where artifacts were found. Their recordkeeping can be as simple as assigning a letter or number for each site, or keeping artifacts from each site separately in containers (Hofman 1992b), but this sort of recordkeeping is still extremely helpful in learning about the past. Relic collectors who are not responsible and lose contextual information about an artifact or the artifact itself are essentially destroying information about the past. If good records are kept by avocational archaeologists with collections then their collections can be valuable additions to the archaeological documentation of a site or region.

Avocational archaeologists who have collected artifacts at a site or region over an extended period of time can amass collections that are much more representative of the archaeology of a site or region than that found in the limited excavations and once-over surveys performed by archaeologists. Since archaeologists spend relatively little time doing fieldwork and what is known about a site or region is usually confined to fieldwork done in a short amount of time (Hofman 1992b); this often leads to incomplete knowledge about a site or region. If we avoid working with avocational archaeologists with collections who keep records of their finds we are excluding the very individuals that possibly have the most information about archaeological materials from a site or region (Hofman 1992b). The importance of local avocationals has been recognized by some government agencies. For example, the U.S. Army Corps of Engineers have allotted time and money for their archaeologists to interview local avocational archaeologists. Ultimately, if archaeologists limit their study to public collections, they will likely miss the variability that can be learned about a site or region when private collections are included in our research.

Often times important archaeological sites can be missed if archaeologists do not work with local avocationals. Hofman (1992b) reports that while working on the Duck River in Tennessee, a site was originally evaluated as non-significant based on a single archaeological survey by the original contract archaeologist. This site was brought to his attention after a local avocational informed him about the site's significance as a shell midden. The site was threatened by an impending reservoir project and had it not been for a local avocational archaeologist, this site would never have been studied. If professional archaeologists ignore local avocational archaeologists, this can have significant consequences to our understanding of the archaeology of a site or region. Archaeologists need to work with local avocationals so that important sites and collections are not overlooked.

When we accept the fact that archaeologists have limited time and funding, it is important to ask can archaeology as a profession afford to ignore the private collections of avocational archaeologists? When we stop to consider the knowledge that is at stake, does it make sense to lump avocational archaeologists with relic collectors by ignoring private avocational collections? According to Hofman (1992b) archaeologists cannot possibly study all sites or regions. Even when archaeologists do excavate sites, these sites are typically only sampled and not completely excavated. Therefore, surface artifacts in private collections can add important and vital information to what archaeologists know and can learn about sites. Often times, archaeologists have questions they want to ask which concern regions, as opposed to specific sites (Hofman 1992b). In these instances, more relevant information can be learned by examining many private surface collections across a region than through the excavation of solitary sites. Therefore, for large regional-scale studies, the use of private collections is vital since using data collected by avocationals allows us to ask and answer questions on a regional scale.

When relying upon private collections for research, archaeologists must exercise time and patience and build mutual trust to determine the dependability of provenience information (Hofman 1992b). A researcher must assess whether the avocational took care to reliably document the location where an artifact was found. Hofman (1992b) notes that the trustworthiness of provenience information is of concern even when using museum collections; this is not a concern that is unique to working with private collections. In the end, using private collections enables a much more complete study of an entire region. This is true even for site-based studies; incorporating private collections enables a more complete study of a specific site's assemblage. By taking the time and care to build relationships with avocationals, professional archaeologists can be more assured of provenience information of private collections and more thoroughly document the archaeology of a site or region. The process is also one of education and improving future documentation of archaeological evidence.

Other reasons for working with avocational archaeologists for archaeological research is it provides an avenue for avocationals to become integral to the future stewardship and research possibilities of their collections. Private collections can become separated from their associated records if they are not housed at museums (Hofman 1992b). If private collections are given away or sold at garage sales or estate sales after the death of the individual who originally found them, then the associated artifact information is likely lost or separated from the artifacts and the collection is likely to become scattered thus making the artifacts little more than novelties. The possibility to learn about the past from these collections will have been lost or reduced. If, however, an avocational donates the collection to a museum the collection can be kept together with its associated information and records and long-term curation can be more assured. Instead of having the collection dispersed and separated from its provenience information, an avocational can donate it to an institution for extended curation and care. A collection that is donated to a museum can become an honor and legacy to the person that originally collected it (Hofman 1992b). In addition, a private collection donated to a museum is intact and always available to be studied, whereas if it becomes scattered among relatives, or sold individually, we lose much of the potential to learn about the past from it. It is only through working with avocationals, as opposed to ignoring them, that we can have avenues for educating them about the importance of their collections to archaeological research; also, by working with avocationals we can impart the knowledge that museums are often the best place for the long-term care, curation, and future study of the their collections.

When we think of the importance of avocational archaeologists we must also be realistic. Professional archaeologists and private institutions and museums have limited time and funding. In some cases, avocational archaeologists can be as good or better stewards of collections than some poorly funded public institutions and/or poorly curated public collections. In some cases, private individuals may have more time and financial means than professional archaeologists and public agencies to attend to preserving the archaeological record. Often, it is more effective (in terms of cost, time, and energy) to have an avocational archaeologist monitoring and surface collecting at the same site, locality, or region over a period of a number of years, than it is to have a single, expensive excavation done by professional archaeologists.

Richard Rose, an avocational archaeologist, who has collected artifacts at the Shifting Sands site in Texas for over 30 years, is an outstanding model of an avocational archaeologist who has worked with a professional archaeologist. He is an example of how an avocational can be an asset to documentation and stewardship of the archaeological record. He has been able to monitor and collect artifacts at this site, which is continuously changing because of wind erosion; therefore artifacts are continuing to erode out onto the surface. He has shared the archaeological information he gathers with numerous professional archaeologists. This type of archaeological monitoring of and information gathering from a site would not be possible if the archaeology performed at Shifting Sands were limited to only professional archaeologists. In addition, because of Rose's continuous monitoring and surface collecting at this site, he is able to inform professional archaeologists if the site is being threatened by looters or destructive forces; and therefore subsequent protective measures need to be put in place by professional archaeologists in order to protect the site. He has made arrangements for his collection and the associated information to go to a public institution upon his death. Professional archaeologists need to work in conjunction with the private sector in order to achieve the best possible preservation of the archaeological record. The Shifting Sands site underscores how collaboration between avocational and professional archaeologists can result in a more complete picture of a site and even result in the donation of a private collection to a museum for long-term curation and future study. Because the majority of this study uses private collections, the ethical issues with working with private collections and importance of using private collections must be discussed.

Discussion of the Limitations of This Study: Problems with Inferring Patterns of Mobility from Lithic Material Distributions

Lithic material distributions are not sufficient for inferring patterns of mobility. The three discussions of how lithic material economy does not directly represent mobility presented here are: Brantingham (2006), Sellet (2006), and Ingbar (1994). Brantingham (2006) addressed the connection between patterns of mobility and the distribution of lithic material. He built a model of forager mobility based on the application of the Lévy random walk. Through this model he ran simulations which could be used to gain information about forager mobility using lithic material transport distances. In summary, Brantingham concluded that moves of identical lengths or continuous short moves by foragers are equated with minimal levels of planning depth in his model; while forager moves, which transport stone, that are longer in distance and have increased unevenness in their lengths, denote higher levels of planning depth (Brantingham 2006:444-445). Brantingham addressed the problem with inferring patterns of mobility from lithic raw material distributions. He particularly investigated the patterns of mobility of foragers as to the length and frequency of their residential moves. He stressed that models of the discard and transport of lithic materials should take into account that foragers have transported lithic material through a certain number of residential moves and not that foragers have made only one move between the lithic material source and where the tool stone was eventually found.

Brantingham's (2006) article underscores the mistake that many archaeologists regularly make—that of deducing the land use of hunter-gatherers from the quantity and distribution of lithic materials. His study showed that land use models that use simple linear distance from the source come up short—because they assume that only one move was made between the source and where the tool was found. His study has important implications for my data sample and study of Folsom land use in the Central Plains. I used more than just simple lithic material distributions and linear distances from the tool stone source to get at Folsom land use. I incorporated many lines of evidence to get at land use—such as the way Folsom chipped stone technology was organized, the variability in the amount of tool use between trips to lithic material sources, and the direction of movement in relation to lithic material sources.

Brantingham's (2006) formal model and simulations provide an important addition to modeling forager mobility and land use. Additionally he examined the problem of inferring mobility from the distributions and abundance of lithic materials. A limitation of his study is that it may be difficult to apply his model to actual archaeological data given the quantity of simplifying assumptions he needed to use to isolate specific variables and achieve the results of his simulations.

Another researcher who cautions against using raw material distributions to infer patterns of mobility is Sellet. His 2006 article demonstrated that the inference of mobility from material economy does not work. He particularly stressed that the local/exotic model does not work. By performing a nodule analysis of artifacts from the oldest four archaeological components at locality one at the Hell Gap site in southeastern Wyoming, Sellet was able to demonstrate that even though 95% of the lithic materials at the site were local in origin (Sellet 2006:226); tools made from local lithic materials were not always manufactured on site and therefore, were not expediently made tools. This was especially the case with the tool class of endscrapers—unlike gravers, which were usually made at the site, endscrapers were made elsewhere and then transported to the site. Thus, this made endscrapers part of the transported toolkit (Sellet 2006:228). Sellet's 2006 study revealed that the local/exotic model does not hold up to scrutiny. Therefore, Sellet demonstrated that using raw material distributions to infer mobility patterns of Paleoindians is problematic.

Now I will turn to discussing how Ingbar (1994) addressed the problem with inferring patterns of mobility from lithic material source proportions. Archaeologists habitually and in an informal way infer the land use of hunter-gathers from the distribution and quantity of lithic material from material sources. Ingbar (1994) performed some simulations that held the following factors constant: location and number of material sources, the number of tools expended at each location, and the direction of movement. His simulations altered only the mobility rate, the number of events that depleted tools, and the number of tools in the toolkit. From his simulations he concluded a poor association existed between the proportions of raw material sources and patterns of mobility (Ingbar 1994:46).

For two of Ingbar's simulations, the results showed that depending on where in the simulation cycle one were to take a sample, if the occurrence of raw material sources in the assemblage was used to infer the group's territory or mobility pattern, one could easily infer that not all three raw material sources were part of the group's territory (Ingbar 1994:49). In Ingbar's last simulation, when the parameter of the number of tools contained in the group's toolkit was changed, or in other words when a characteristic of the technological organization was changed, this resulted in yet another and different pattern of material source proportions (Ingbar 1994:51). He deduced from this that the proportions of material sources are extremely reactive to patterns in technological organization. He emphasized that knowing about the organization of a technology, past the utilization of certain sources of materials, is a requirement for understanding the different patterns in the proportions of material sources (Ingbar 1994:50). Ingbar (1994: 50, 54) defined the study of technological organization as the study of patterns in acquiring lithic material and lithic tool production, transport, use, modification, and discard; this is similar to the chaîne opératoire (Sellet 1993).

To illustrate the connecting of material source use to technological organization, Ingbar presented an example from the Hanson site, located in northwestern Wyoming (Ingbar 1994:51). At the Hanson site, almost the whole projectile point and biface manufacturing sequences were found. However, Ingbar points out that these sequences showed a segmented pattern in terms of lithic material—between the local and non-local materials (Ingbar 1994:52; also see Ingbar 1992:186). By a segmented pattern between the local and non-local lithic materials, Ingbar means that "while nearly complete biface and projectile point production sequences have been recovered at the Hanson site, these sequences are not present in the local materials" (Ingbar 1992:186). In other words, complete biface and projectile point production sequences exist for the non-local lithic materials at the Hanson site, but this is not the case for the local lithic materials at the site. He proposed that this segmented pattern in lithic raw materials was the result of a certain organizational strategy, that of serial flexibility (cf. Nelson 1991:83)—which is when a toolkit is continuously provisioned. When serial flexibility is associated with "serial or irregular source use, only the last few sources visited may appear in the active toolkit" (Ingbar 1994:52).

Ingbar concluded that the representation of lithic raw materials in archaeological assemblages was strongly connected to a group's technological organization strategies (Ingbar 1994:54). Explanations of a group's territory or range and mobility patterns based only on material source proportions, with the type of technological organization strategies shown in Ingbar's simulations and his example from the Hanson site would be misinforming. Ingbar argues that direct correlations of material source proportions with mobility are precarious. However, he does conclude that the identification of lithic material sources is a significant addition to technological organization studies, and they must advance together (Ingbar 1994:54).

Brantingham's (2006), Ingbar's (1994), and Sellet's (2006) articles underscored the importance of including the study of technological organization in archaeological research. Ingbar (1994:50, 54) defines the study of technological organization as the study of patterns in acquiring lithic raw material, and lithic tool production, transport, use, discard, and modification.

Description of the Sample

Since few diagnostic Folsom artifacts exist from excavated contexts in the area of this study, it is essential to use the available information about the Folsom archaeological record to explore land use at a large regional scale. This available information is confined to surface diagnostic Folsom artifacts (projectile points, preforms, and channel flakes). The data for this study was obtained from private collections (found through word-of-mouth), public collections, and published accounts of diagnostic Folsom artifacts. The dataset consists entirely of surface artifacts. Only a few recorded sites are represented in the sample and these are also surface collections.

The Central Plains Folsom dataset consists of 317 Folsom artifacts, including the following: 227 projectile points and point fragments, 50 preforms, 9 channel flakes, and 31 Midland points. Dr. Jack Hofman began recording artifacts for this study in the 1970s. His recording of Folsom artifacts is ongoing—he continues to record Folsom artifacts from both private and public collections throughout the Plains.

Description of Data Collection and Variables Recorded and Coding of the Data

Overall, the data for this study was collected in an opportunistic manner as time permitted. Some of the data collection was snowball, or collected in a word-of-mouth manner, in that one collector would know of other collectors that could be contacted for documentation of artifacts in their collection to include in this study. Some of the data was collected systematically by going through site records. The public museums and institutions contacted were the University of Nebraska State Museum (UNSM) and the Nebraska State Historical Society (NSHS). Although strategies such as snowball and systematic sampling were used, overall the data was collected in an opportunistic way.

In terms of the private collections, sixty-four avocational archaeologists' collections are represented in the sample of Folsom artifacts. Avocational archaeologists with collections were found by looking at the Nebraska site files and notes and through Dr. Steve Holen's contacts with landowners and avocational archaeologists with collections. In addition, avocational archaeologists were found by following leads from early professional archaeologists' reports.

After the artifacts were recorded, they were given a unique specimen number with the letter "N" before the number (e.g., N1, N2, N3….). The following variables were recorded and later coded for the sample of artifacts. The variables coded include the following: county name where the artifact was found; name of the locality where the artifact was found (if applicable); site number (in the rare instances when the artifact was found at a surface site); river drainage where the artifact was found; context of artifact find (e.g., blowout, streambed, terrace, upland); ecoregion in which the artifact was found (i.e., Central Great Plains, Nebraska Sand Hills, Western High Plains, etc.); latitude and longitude; lithic material (e.g., White River Group Silicate, Niobrara Jasper, Hartville Uplift); name of collection (whether in a private or public collection); specimen number written on the artifact by a private avocational archaeologist with collections or public institution; artifact type (i.e., Folsom point, Folsom preform, channel flake, Midland point); the number of flutes on the artifact; portion of the artifact (i.e. complete, projectile point tip, projectile point base); maximum length of the artifact (recorded in centimeters—up to three decimal places); references where the artifact was described if recorded from a publication; and any technical notes about the artifact.

Chapter 3: Pattern Recognition in the Data: Overall Spatial Patterns

Introduction

Different kinds of projectile point fragments and preforms can potentially inform us about different elements of Folsom people's activities or concentrations of their activities. Complete projectile points can be lost in hunting at kills or elsewhere. Projectile point bases may be intentionally discarded and indicate camp or retooling sites. Projectile point tips may be lost in carcasses and may be indications of kill areas. Preforms are evidence of point production. Broken preforms can be indications of places where retooling and fabrication of points is occurring. This is useful information in terms of where Folsom groups are carrying out activities on the landscape organizationally in relation to sources.

Overall Folsom Artifact Distribution

The overall Folsom distribution in Nebraska reveals that most of the documented artifacts are found in western Nebraska (Figure 3.1) with a secondary concentration found in the southern tier of Nebraska counties (Williams and Hofman 2010). The sample has obvious data gaps as evidenced by counties with no Folsom evidence (e.g. Logan and Perkins) which are adjacent to counties where Folsom artifacts are commonly found. Keith and Lincoln counties have the most Folsom evidence with 120 Folsom artifacts found in these two counties (Tables 3.2 and 3.3). This area was possibly a place of repeated and focused Folsom activity. The North and South Platte confluence area lies in Keith and Lincoln Counties which are in two different ecoregions. In addition, Keith and Lincoln Counties lie adjacent to a third ecoregion. It is important to note that the concentration of Folsom evidence at the North and South Platte River confluence area does not extend eastward along the Platte River. The North and South Platte River confluence is an area with diverse resources which would have been attractive to bison and other species—and to the people who hunted those animals. Part of the ecological diversity and the interest in this area by Folsom people may be because three ecoregions come together near the North and South Platte River confluence area (i.e., the Nebraska Sand Hills, Western High Plains, and Central Great Plains). The North and South Platte River confluence area appears to be a “hot spot” for Folsom evidence. Other areas that could be considered as “hot spots” for Folsom include the San Luis Valley, Middle Park, and Upper Gunnison Basin in Colorado and Central Rio Grande Valley in New Mexico (see Andrews et al. 2008:481).

The overall Folsom distribution also highlights areas where little to no evidence exists—specifically in northeastern Nebraska. The distribution of Folsom and Clovis in Nebraska are both uneven. But these distributions are distinctly different from one another (see Figures 4.1 and 4.2). By comparing the Folsom distribution to other late Pleistocene–early Holocene evidence, we see that Clovis is well-represented in northeastern Nebraska. The presence of Clovis artifacts in the area suggest that we should expect to find Folsom, because the exposed land surfaces are old enough. Nor does the lack of Folsom evidence in northeastern Nebraska reflect a lack of archaeological research or documentation of artifacts in this area, Clovis is well represented here (Holen 2001, 2003). The lack of Folsom artifacts in northeastern Nebraska could reflect limited activity of Folsom people in the area. Perhaps this overall distribution points to the low population of Folsom people in northeastern Nebraska, while their presence was concentrated in western and southern Nebraska and especially the Platte River system. Evaluating these patterns and their causes is a central focus of this study.

Looking at the number of artifacts by ecoregion is revealing (Table 3.1, Figure 3.2). The ecoregion with the most Folsom evidence is the Central Great Plains (80 artifacts), followed by the Nebraska Sand Hills (75 artifacts), and the Western High Plains (72 artifacts). The number of artifacts found in the streambed of the South Platte River is also high (72 artifacts) while the number found in the North Platte is low (only 5 artifacts). The Corn Belt Plains in the far eastern portion of Nebraska also is severely underrepresented in terms of the Folsom evidence with only 2 artifacts found in this ecoregion. Finally, two ecoregions in the northeastern and north central part of Nebraska, the Northwestern Glaciated Plains and the Northwestern Great Plains, had no documented samples of Folsom artifacts. Table 3.1 shows that Western High Plains appears to have the greatest density of artifacts as the size of this ecoregion (35,735 km^2) is a little less than half the size of the Central Great Plains (60,047 km^2) and Nebraska Sand Hills (57,860 km^2). The ecoregions with the most Folsom evidence are located in western Nebraska and the ecoregions with the least evidence are in the northeastern part of the state.

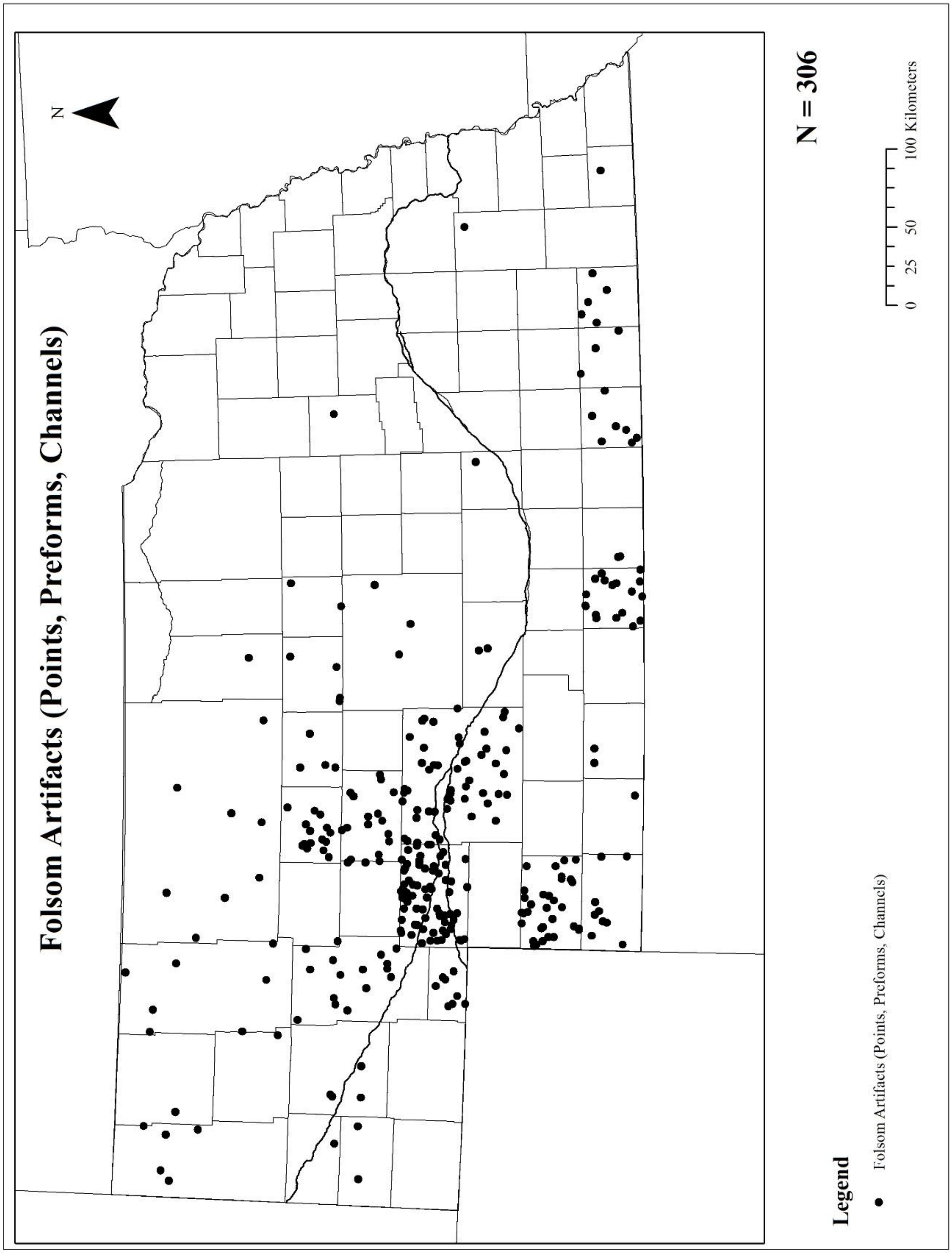

Figure 3.1: Overall Folsom Artifact Distribution by County

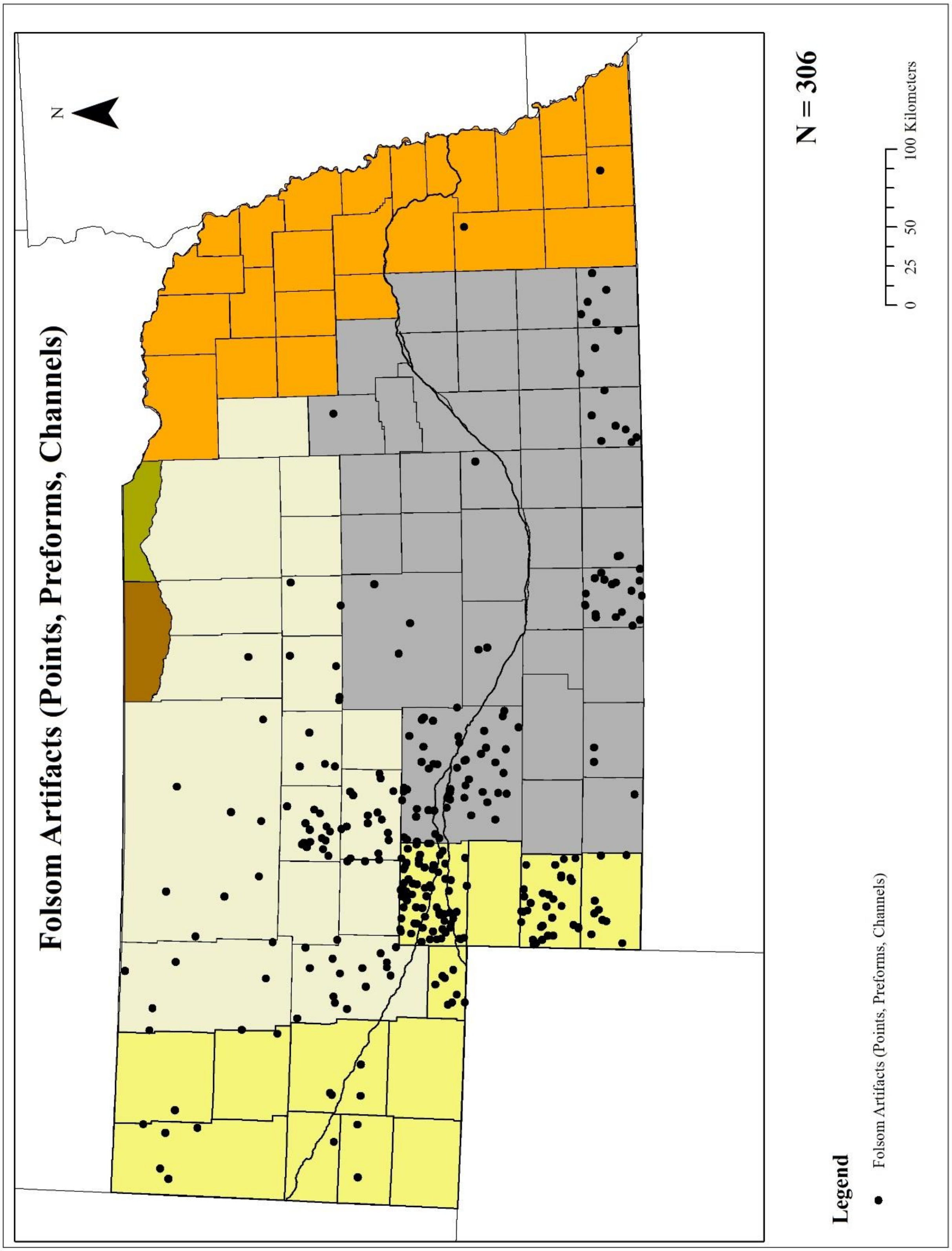

Figure 3.2: Overall Folsom Artifact Distribution by Ecoregion

Table 3.1: Number of Folsom Artifacts by Ecoregion and Size of Region

ECOREGION/REGION	# FOLSOM ARTIFACTS	AREA (KM^2)
CENTRAL GREAT PLAINS	80	60,047
NEBRASKA SAND HILLS	75	57,860
WESTERN HIGH PLAINS	72	35,735
CORN BELT PLAINS	2	35,550
NORTHWESTERN GREAT PLAINS	0	5,575
NORTHWESTERN GLACIATED PLAINS	0	5,515
NORTH PLATTE RIVER*	5	NA
SOUTH PLATTE RIVER*	72	NA
TOTAL FOR STATE OF NEBRASKA	**306**	**200,282**
*Note: Only artifacts found in the streambeds of the North and South Platte rivers were assigned to these regions.		

Table 3.2: Artifacts Found in Keith and Lincoln Counties

-	ARTIFACT TYPE				
COUNTY	**FOLSOM POINTS**	**MIDLAND POINTS**	**FOLSOM PREFORMS**	**CHANNEL FLAKES**	**TOTALS**
KEITH	43	9	15	3	**70**
LINCOLN	29	8	12	1	**50**
TOTALS	**72**	**17**	**27**	**4**	**120**

Table 3.3: Lithic Materials Found in Keith and Lincoln County

	MATERIAL					
COUNTY	**HARTVILLE UPLIFT**	**WHITE RIVER GROUP SILICATES**	**SMOKY HILL JASPER**	**PERMIAN**	**OTHER***	**TOTALS**
KEITH	17	26	3	—	24	**70**
LINCOLN	11	15	6	1	17	**50**
TOTALS	**28**	**41**	**9**	**1**	**41**	**120**
OTHER* = ALIBATES, EDWARDS, FOSSIL WOOD, KNIFE RIVER FLINT, PORCELLANITE, QUARTZITE, TONGUE RIVER SILICIFIED SEDIMENT, UNIDENTIFIED CHERT						

Table 3.4: Lithic Materials Found in the Platte River Drainage System

	MATERIAL					
DRAINAGE	**HARTVILLE UPLIFT**	**WHITE RIVER GROUP SILICATES**	**SMOKY HILL JASPER**	**PERMIAN**	**OTHER***	**TOTALS**
NORTH PLATTE*	13	13	3	—	15	**44**
SOUTH PLATTE*	20	33	7	—	21	**81**
MIDDLE PLATTE*	1	—	—	—	1	**2**
PLATTE*	3	2	1	—	3	**9**
TOTALS	**37**	**48**	**11**	**0**	**40**	**136**
OTHER* = ALIBATES, EDWARDS PLATEAU, FOSSIL WOOD, KNIFE RIVER FLINT, PORCELANITE, QUARTZITE, TONGUE RIVER SILICIFIED SEDIMENT, UNIDENTIFIED CHERT						
NORTH PLATTE* = INCLUDES SPECIMENS FROM BANNER, GARDEN, KEITH, LINCOLN, MCPHERSON, MORRILL, AND SCOTTSBLUFF COUNTIES						
SOUTH PLATTE* = INCLUDES SPECIMENS FROM DEUEL, KEITH, LINCOLN, MCPERSON COUNTIES, AND N/A						
MIDDLE PLATTE* = INCLUDES SPECIMENS FROM HALL AND DAWSON COUNTIES						
PLATTE* = INCLUDES SPECIMENS FROM LINCOLN COUNTY						

Overall Distributions of Reduction Stages

Folsom and Midland Projectile Point Distribution. The definition of a Folsom point used in this study follows Ahler and Geib 2000. "The Folsom point is a distinctive spear or atlatl dart tip used to hunt primarily extinct forms of bison on the grasslands of North America in the period *c.* 10,900–10,200 BP (Haynes 1993). The point is unmistakable…characterized by precision marginal pressure flaking and a broad channel flake scar from base to tip on each face" (Ahler and Geib 2000:799). A Midland point is defined here as an unfluted Folsom point and in general agrees with the assessment that differences between Folsom and Midland points "…are not explainable simply with reference to cultural differences. Situational factors of individual hunters, such as the availability of raw material, and the estimated potential for gaining replacement lithic material in the near future, may have had a determining influence on decisions about whether to manufacture fluted or unfluted points (Hofman et al. 1990:222-223).

The Central Plains Folsom sample has 219 Folsom projectile points and 30 Midland projectile points (Table 3.5). The total number of Folsom and Midland points is 249. Figure 3.3 shows that Folsom and Midland points have similar distributions—occurring mostly in western Nebraska and along the southern tier of Nebraska counties. The primary concentration of projectile points is in Keith and Lincoln counties at the confluence of the North and South Platte Rivers. Northeastern and east-central Nebraska have few Folsom points and no Midland points. Folsom and Midland points occur in 4 ecoregions and in the North and South Platte River streambeds (Table 3.6, Figure 3.4). The ecoregions and river streambeds with the most Folsom and Midland points are the Nebraska Sand Hills (68 Folsom and 3 Midland points), Central Great Plains (59 Folsom and 10 Midland points), Western High Plains (45 Folsom and 14 Midland points), and South Platte River (42 Folsom and 3 Midland points). Both the North Platte

River (3 Folsom and 0 Midland points) and Corn Belt Plains (2 Folsom and 0 Midland points) had sparse Folsom evidence. The Corn Belt Plains lies in the eastern quarter of Nebraska and this ecoregion has little Folsom evidence in general for all artifact types.

Table 3.5: Artifact Type by County

	ARTIFACT TYPE				
COUNTY	**FOLSOM POINTS**	**MIDLAND POINTS**	**FOLSOM PREFORMS**	**CHANNELS**	**TOTALS**
ARTHUR	1	1			**2**
BANNER	1	1			**2**
BLAINE	4				**4**
BOONE	1				**1**
BOX BUTTE	1				**1**
BROWN	1				**1**
CHASE	18	4	5	5	**32**
CHERRY	7		1		**8**
CUSTER	4				**4**
DAWES	1				**1**
DAWSON	2				**2**
DEUEL	6		2		**8**
DUNDY	9				**9**
FRANKLIN	2				**2**
GARDEN	14	1			**15**
GRANT	1				**1**
HALL	1				**1**
HARLAN	13	2	3		**18**
HITCHCOCK	1				**1**
HOOKER	13		2		**15**
JEFFERSON	3		2		**5**
KEITH	43	9	15	3	**70**
LANCASTER	1				**1**
LINCOLN	29	8	12	1	**50**
LOUP	1		1		**2**
MCPHERSON	15	1			**16**
MORRILL	2	2			**4**
NUCKOLLS	5		2		**7**
PAWNEE	1				**1**
RED WILLOW	2				**2**
SCOTTS BLUFF			1		**1**
SHERIDAN	7				**7**
SIOUX	4	1			**5**
THAYER	1		2		**3**
THOMAS	4				**4**
TOTALS	**219**	**30**	**48**	**9**	**306**

Table 3.6: Artifact Type by Ecoregion

	ARTIFACT TYPE				
ECOREGION	**FOLSOM POINTS**	**MIDLAND POINTS**	**PREFORMS**	**CHANNELS**	**TOTALS**
WESTERN HIGH PLAINS	45	14	7	6	72
SOUTH PLATTE RIVER	42	3	24	3	72
NEBRASKA SAND HILLS	68	3	4	0	75
NORTH PLATTE RIVER	3	0	2	0	5
CENTRAL GREAT PLAINS	59	10	11	0	80
CORN BELT PLAINS	2	0	0	0	2
TOTALS	219	30	48	9	306

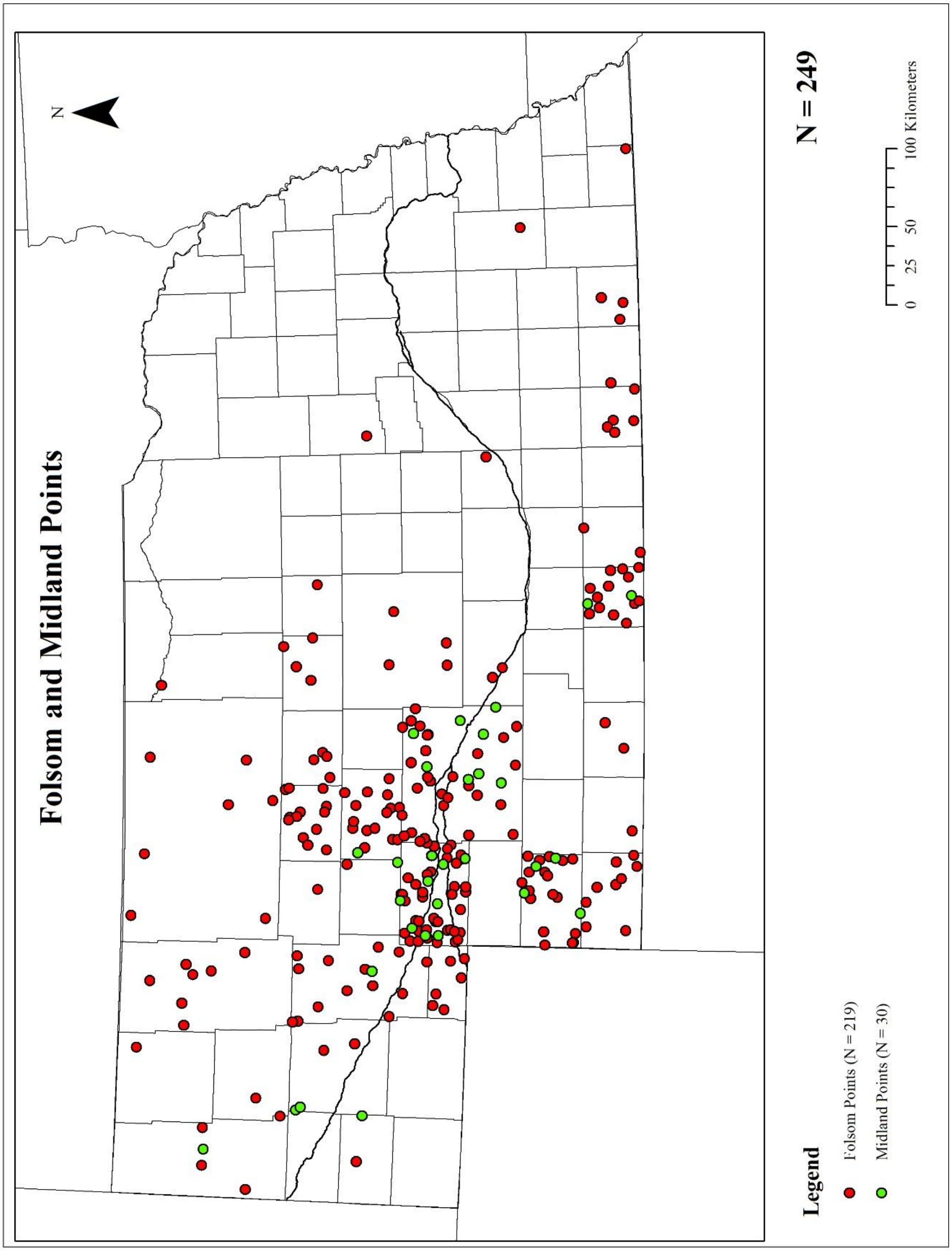

Figure 3.3: Folsom and Midland Projectile Point Distribution by County

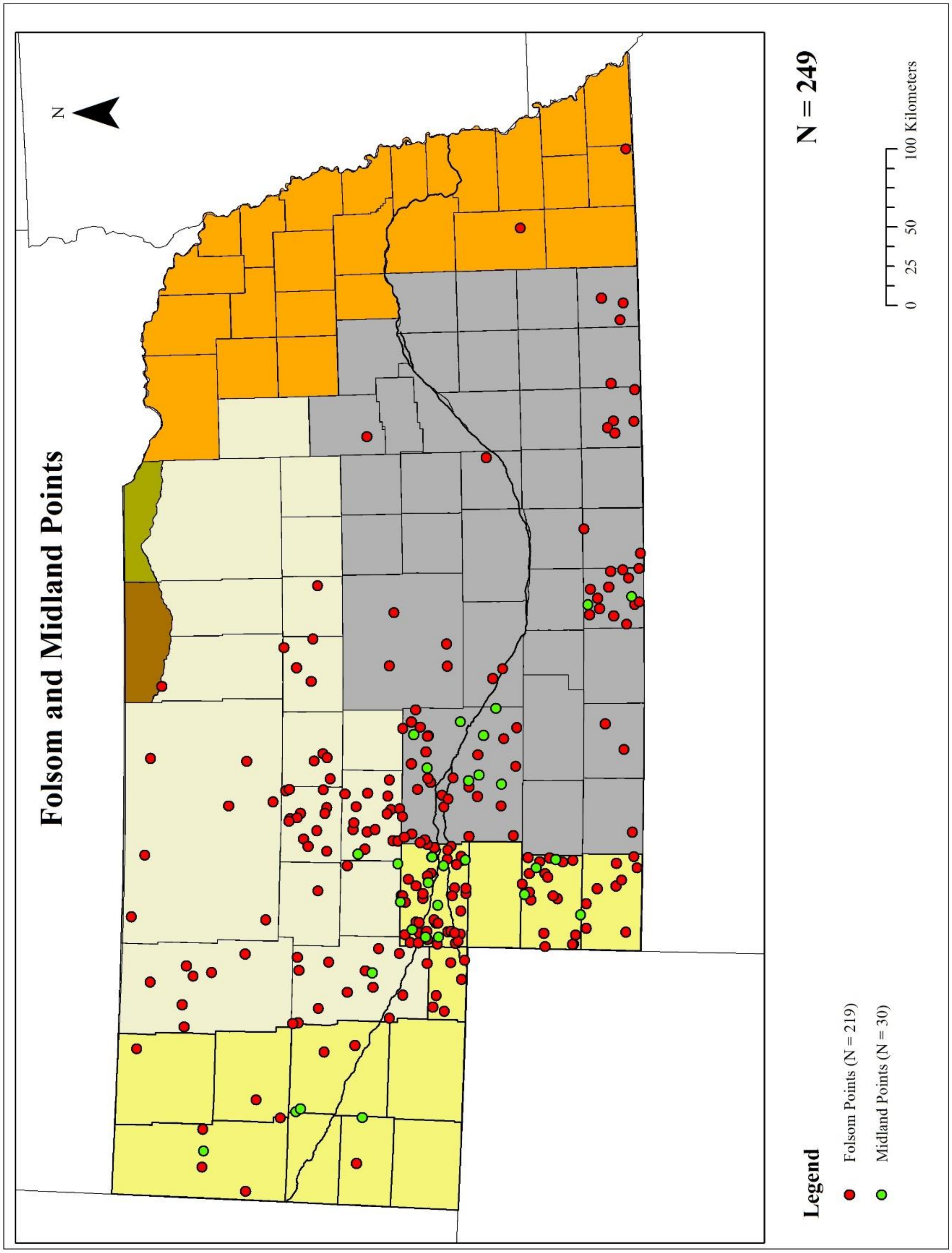

Figure 3.4: Folsom and Midland Projectile Point Distribution by Ecoregion

Preform Distribution. Crabtree (1972) defines a preform as a blank that has in one way or another been additionally modified. For the purposes of this study, a Folsom preform is recognized based on combinations of attributes including basal platform preparation, Folsom type fluting, preform shape, and type of marginal retouch that indicate a Folsom point was being manufactured. The Central Plains Folsom sample has 48 preforms (Table 3.5). Figure 3.5 and Table 3.5 show the primary concentration of preforms occurs in western Nebraska. This concentration occurs near the confluence of the North and South Platte Rivers in Keith and Lincoln Counties (27 preforms) and Chase County of western Nebraska (5 preforms). A secondary concentration occurs in the southern and east-southern tier of counties of Harlan, Nuckolls, Thayer, and Jefferson (9 preforms). The north-eastern part the state is void of documented preforms.

Preforms occur in 3 ecoregions and both the North and South Platte River streambeds (Table 3.6, Figure 3.6). Most preforms were found in the South Platte streambed (24 preforms). The Central Great Plains ecoregion had 11 preforms, but the preform evidence diminishes after that with 7 found in the Western High Plains and 4 in the Nebraska Sand Hills. Only two preforms were found in the North Platte streambed. No preforms were found in the eastern and northeastern ecoregions (the Corn Belt Plains, Northwestern Glaciated Plains, and Northwestern Great Plains). Preforms and fragments of preforms are more recognizable than channel flakes (especially channel fragments) which could be why they are more widespread than channels.

Channel Flake Distribution. The Central Plains Folsom sample includes 9 channel flakes with the primary concentration in Chase County (5 channels), located in southwestern Nebraska (Table 3.5, Figure 3.5). A secondary concentration occurs in Keith (3 channels) and Lincoln (1 channel) Counties located in the area of the North and South Platte River confluence. Table 3.6

and Figure 3.6 show that channel flakes occur in only one ecoregion, the Western High Plains (6 channel flakes) and in the streambed of the South Platte River (3 channels). We have no channel flake evidence for the North Platte River streambed and the Nebraska Sand Hills, Central Great Plains, Corn Belt Plains, Northwestern Glaciated Plains, and Northwestern Great Plains ecoregions. The channel flake evidence is confined to the southwestern and western part of the state.

The current evidence shows that we do not have an adequate sample of channel flakes for a detailed spatial analysis. It really represents only a few sites where they were recognized (i.e., the Nolan site). Folsom preforms are generally larger and more recognizable than channel flakes—which could be why the preforms exhibit a more widespread distribution. Not surprisingly, channel flakes occur within the area of Folsom preform occurrences.

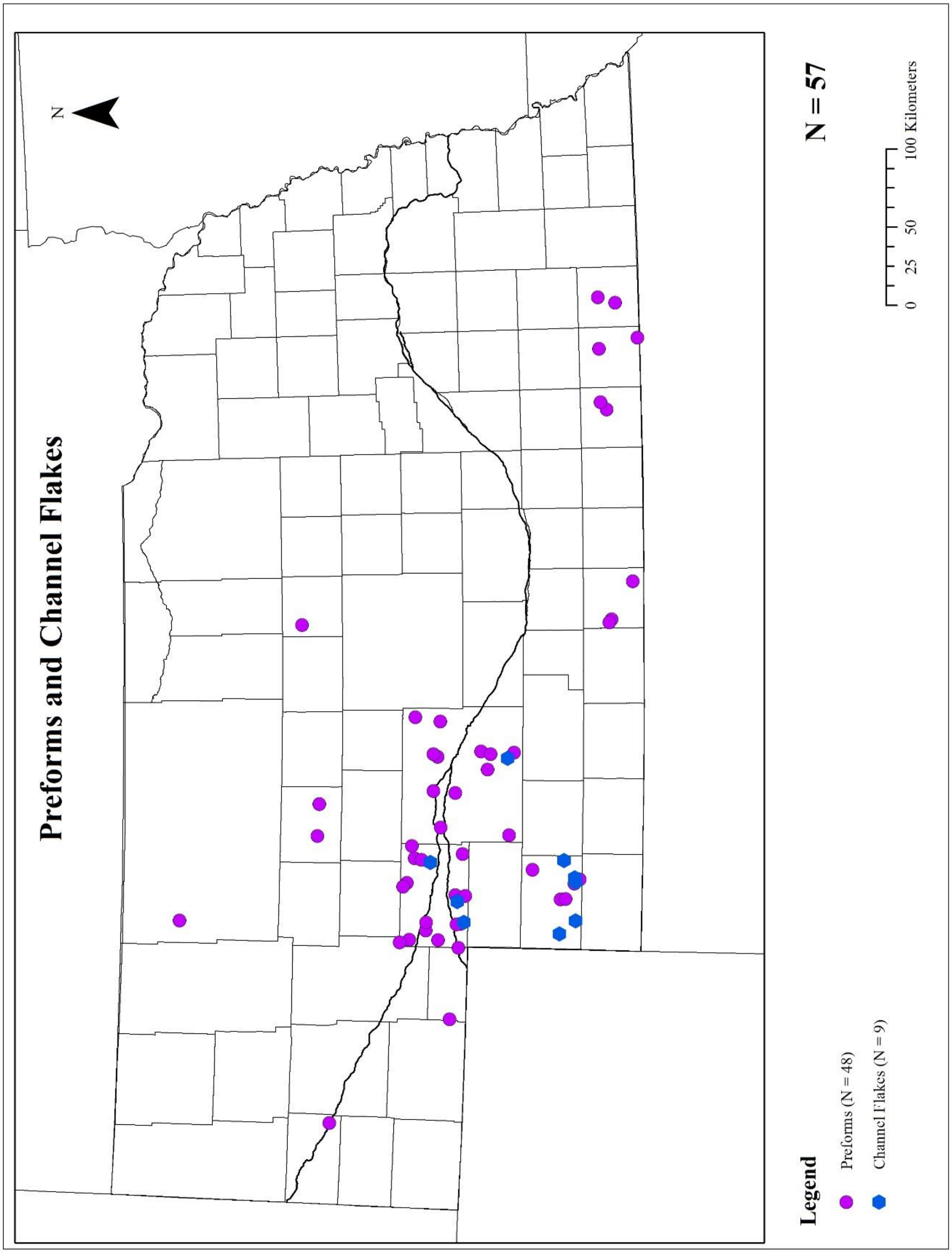

Figure 3.5: Preform and Channel Flake Distributions by County

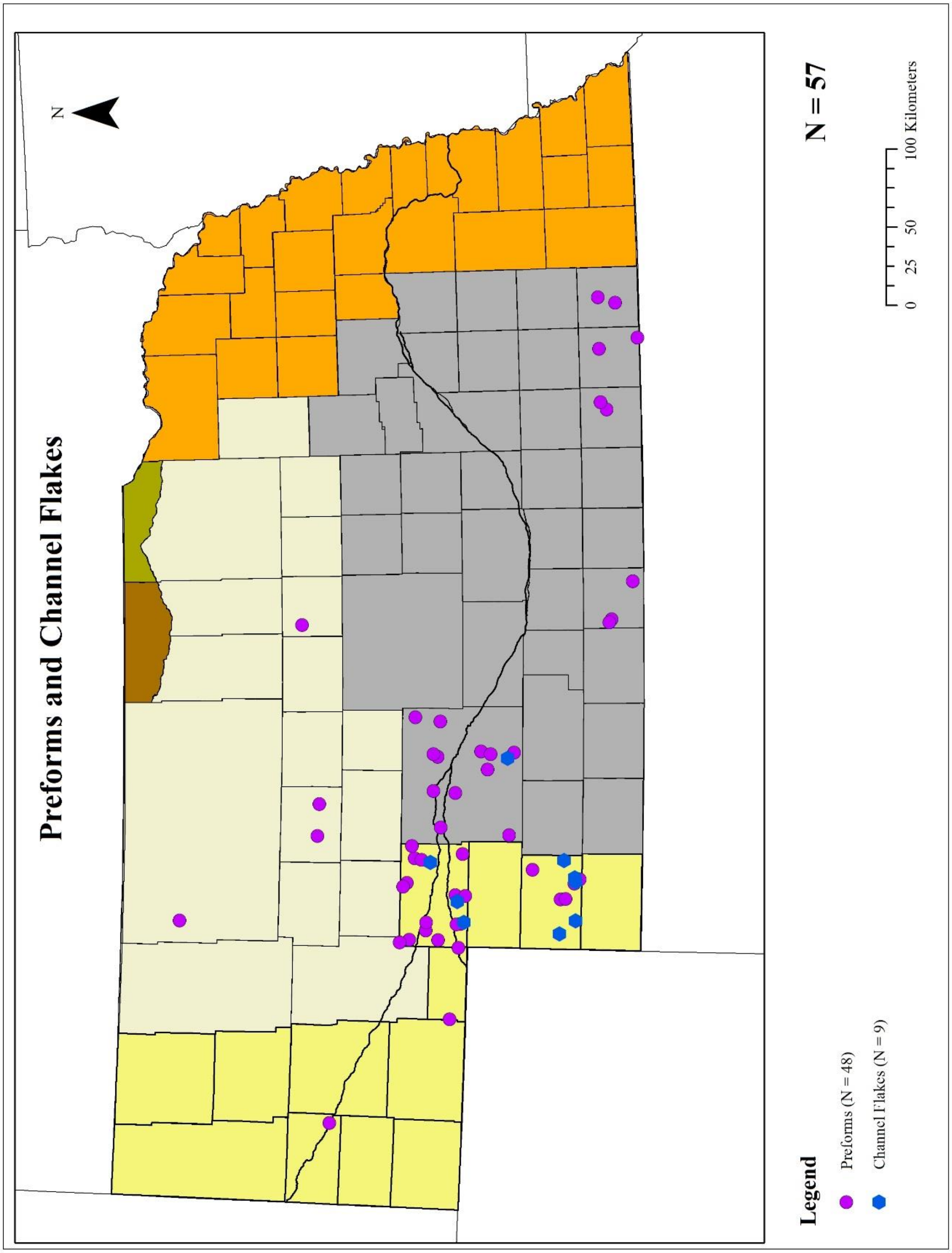

Figure 3.6: Preform and Channel Flake Distributions by Ecoregion

Overall Distributions of Projectile Point Fragment Types

Complete and Nearly Complete Projectile Points Distribution. The Central Plains Folsom database has 97 complete and nearly complete projectile points (Table 3.7, Figure 3.7). The distribution of complete and nearly complete points is more evenly distributed in the western part of the state with one to three complete and nearly complete points occurring in most counties in western Nebraska. The eastern and northeastern part of the state is nearly void of Folsom evidence with only four complete and nearly complete points occurring there. The counties with the most complete and nearly complete points occur in the western portion of Nebraska in Chase (8 artifacts), Hooker (8 artifacts), Harlan (5 artifacts), and Lincoln (6 artifacts) Counties. Keith County has the most complete and nearly complete projectile points with 22 specimens.

Complete and nearly complete points are found in four ecoregions and the North and South Platte River streambeds (Table 3.8, Figure 3.8). The Nebraska Sand Hills has 34 complete and nearly complete specimens, the Western High Plains has 19, and the Central Great Plains has 20 specimens. The eastern ecoregions are sparse in terms of complete and nearly complete points with the Corn Belt Plains having only one specimen and the Northwestern Great Plains and Northwestern Glaciated Plains are void of complete point evidence. Twenty-one specimens were found in the South Platte River streambed, while only two came from the North Platte. Out of 69 complete points, only 27 of them are thought to possibly be discards (where their length was less than 40 mm). The majority of the complete points (42 of them) are thought to be lost in hunting at kills or elsewhere.

Table 3.7: Projectile Point Fragment Type by County

	PROJECTILE POINT FRAGMENT TYPE*						
COUNTY	**COMPLETE POINTS****	**POINT BASES*****	**POINT TIPS******	**BLADES*******	**EDGE**	**OTHER *********	**TOTALS**
ARTHUR	1	1					**2**
BANNER	1	1					**2**
BLAINE	3			1			**4**
BOONE	1						**1**
BOX BUTTE	1						**1**
BROWN				1			**1**
CHASE	8	10	3	1			**22**
CHERRY	4	2				1	**7**
CUSTER	2	1		1			**4**
DAWES				1			**1**
DAWSON	1	1					**2**
DEUEL	2	1	2	1			**6**
DUNDY	4	2		3			**9**
FRANKLIN		2					**2**
GARDEN	3	6	4	2			**15**
GRANT						1	**1**
HALL	1						**1**
HARLAN	5	6	2	2			**15**
HITCHCOCK	1						**1**
HOOKER	8	3		2			**13**
JEFFERSON		2		1			**3**
KEITH	22	12	8	8	1	1	**52**
LANCASTER	1						**1**
LINCOLN	6	15	10	6			**37**
LOUP		1					**1**
MCPHERSON	9	5	2				**16**
MORRILL	2	2					**4**
NUCKOLLS	1	4					**5**
PAWNEE		1					**1**
RED WILLOW	2						**2**
SCOTTS BLUFF							**0**
SHERIDAN	6			1			**7**
SIOUX	1	3	1				**5**
THAYER	1						**1**
THOMAS		4					**4**
TOTALS	**97**	**85**	**32**	**31**	**1**	**3**	**249**

***Includes both Folsom and Midland projectile points**

****The following specimens were designated as complete projectile points: complete, and nearly complete**

*****The following specimens were designated as point bases: base, and base and blade**

******The following specimens were designated as tips: tip, and tip and blade**

*******The following specimens were designated as blade: blade, and blade and edge**

********Other = No information was available on fragment type.**

Table 3.8: Projectile Point Fragment Type by Ecoregion

ECOREGION	PROJECTILE POINT FRAGMENT TYPE*						
	COMPLETE POINTS**	**POINT BASES*****	**POINT TIPS******	**BLADES*******	**EDGE**	**OTHER ********	**TOTALS**
WESTERN HIGH PLAINS	19	25	5	9	0	1	**59**
SOUTH PLATTE RIVER	21	7	11	5	1	0	**45**
NEBRASKA SAND HILLS	34	22	6	7	0	2	**71**
NORTH PLATTE RIVER	2	1	0	0	0	0	**3**
CENTRAL GREAT PLAINS	20	29	10	10	0	0	**69**
CORN BELT PLAINS	1	1	0	0	0	0	**2**
TOTALS	**97**	**85**	**32**	**31**	**1**	**3**	**249**
***Includes both Folsom and Midland projectile points**							
****The following specimens were designated as complete points: complete, and nearly complete**							
*****The following specimens were designated as point bases: base, and base and blade**							
******The following specimens were designated as tips: tip, and tip and blade**							
*******The following specimens were designated as blades: blade, and blade and edge**							
******** Other = No information was available on the fragment type.**							

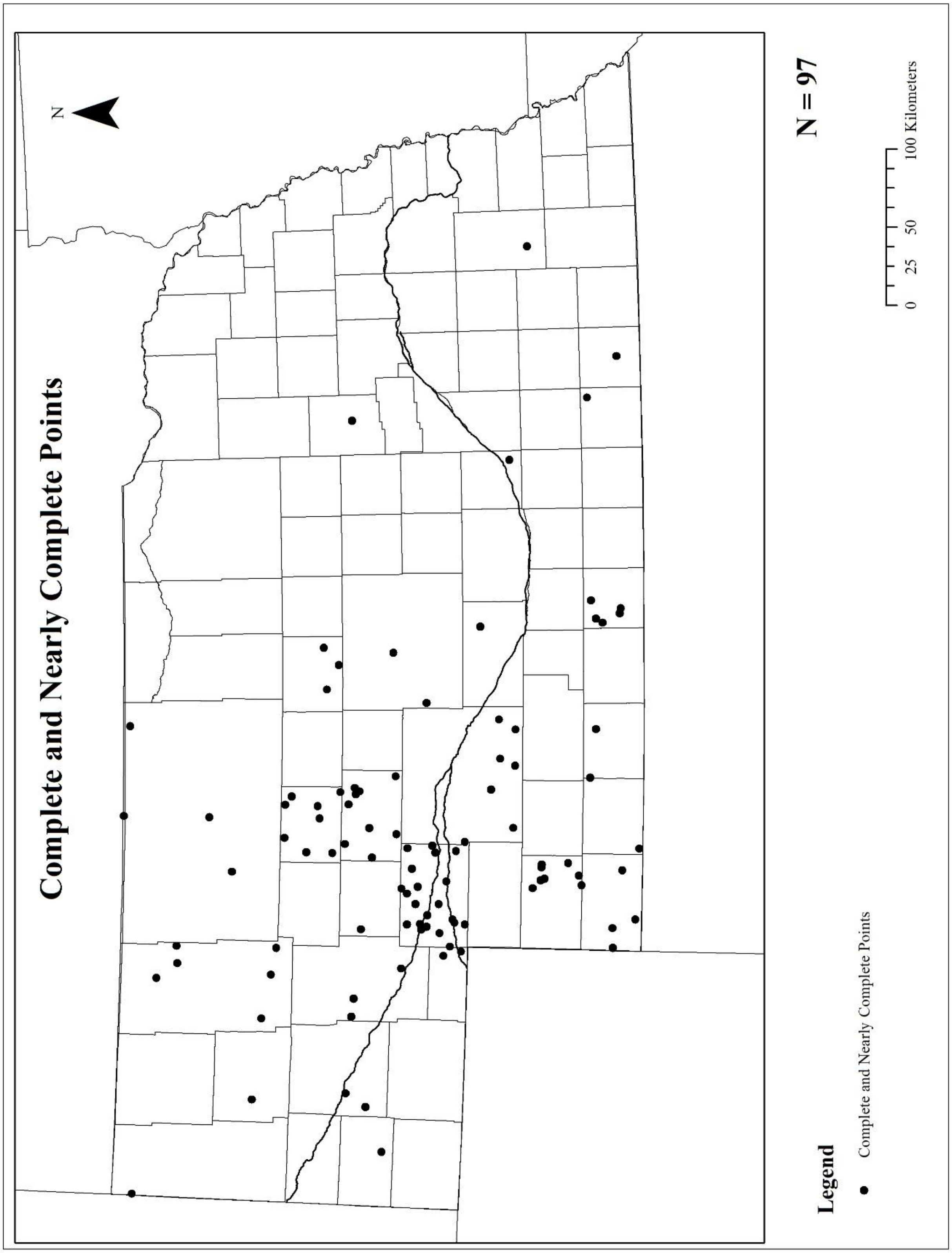

Figure 3.7: Complete and Nearly Complete Projectile Points Distribution by County

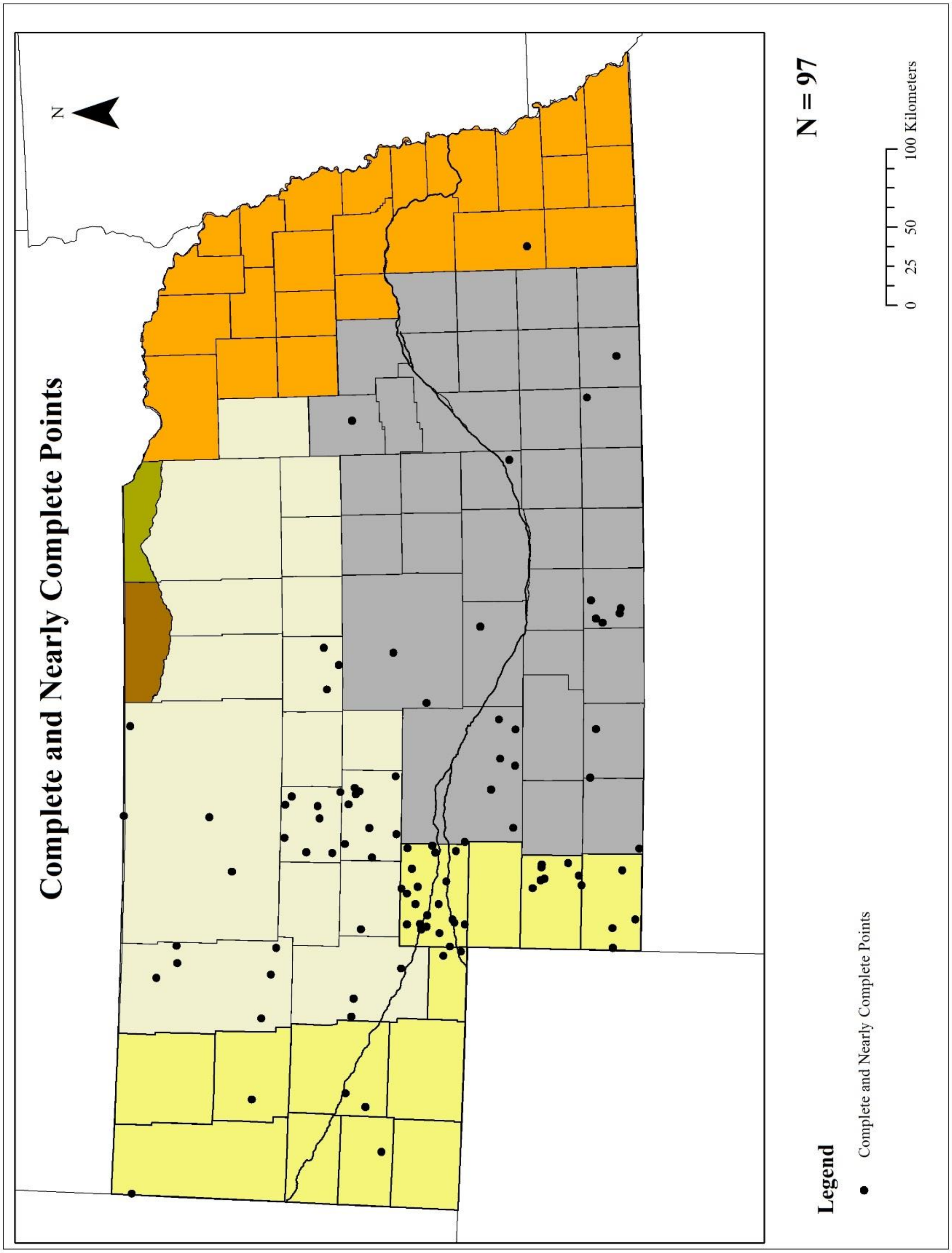

Figure 3.8: Complete and Nearly Complete Projectile Points Distribution by Ecoregion

Projectile Point Blades and Edge Distribution. A projectile point blade is defined here as the middle portion of a projectile point. The projectile point edge is defined as the side margin fragment of a Folsom point. The Nebraska Folsom evidence includes 31 projectile point blades and one edge fragment (Table 3.7). The blades and edge fragments are concentrated in the western half of the state, with only one blade found in the eastern half of Nebraska in Jefferson County (Figure 3.9). Table 3.7 shows the counties with the most projectile point blade fragments are Keith (with eight specimens) and Lincoln (with six specimens). The remaining blade fragments were found in western Nebraska and are scattered among 11 counties which have three or fewer blade fragments per county. The single edge fragment is also from western Nebraska and was found in Keith County.

Projectile point blade and edge fragments were found in three ecoregions and in the South Platte River streambed (Figure 3.10, Table 3.8). The ecoregion with the most blade evidence was the Central Great Plains with 10 specimens. Next follows the Nebraska Sand Hills with seven blades, the Western High Plains with nine blades, and the South Platte River streambed with five blades and one edge fragment. The eastern and northeastern ecoregions (the Corn Belt Plains, Northwestern Glaciated Plains, and Northwestern Great Plains) had no blade and edge fragment evidence.

Blade and edge fragments reflect points broken during use—presumably during hunting—or discarded from hafts during retooling events following use episodes. Like complete points, these fragments probably represent hunting activities.

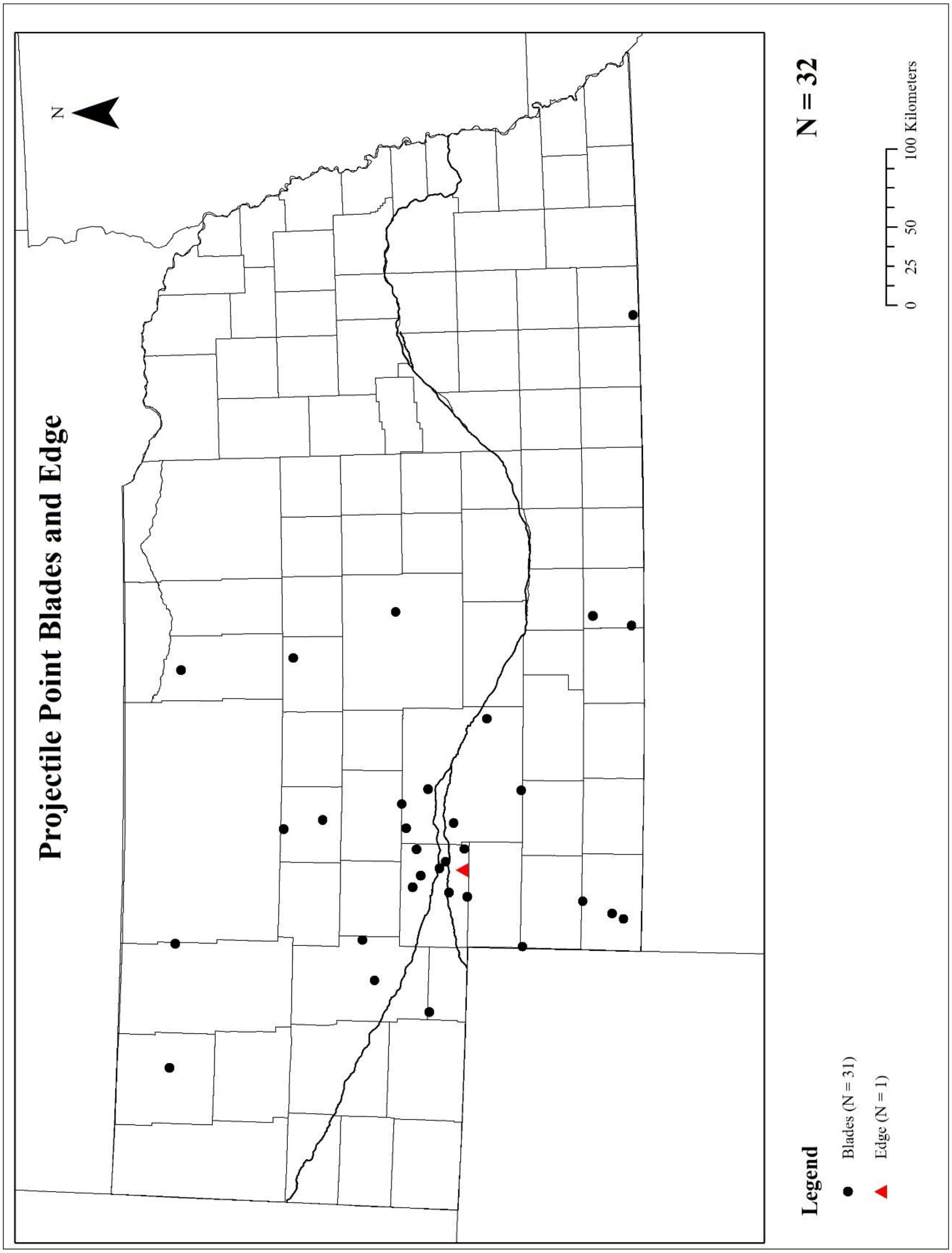

Figure 3.9: Projectile Point Blades and Edge Distribution by County

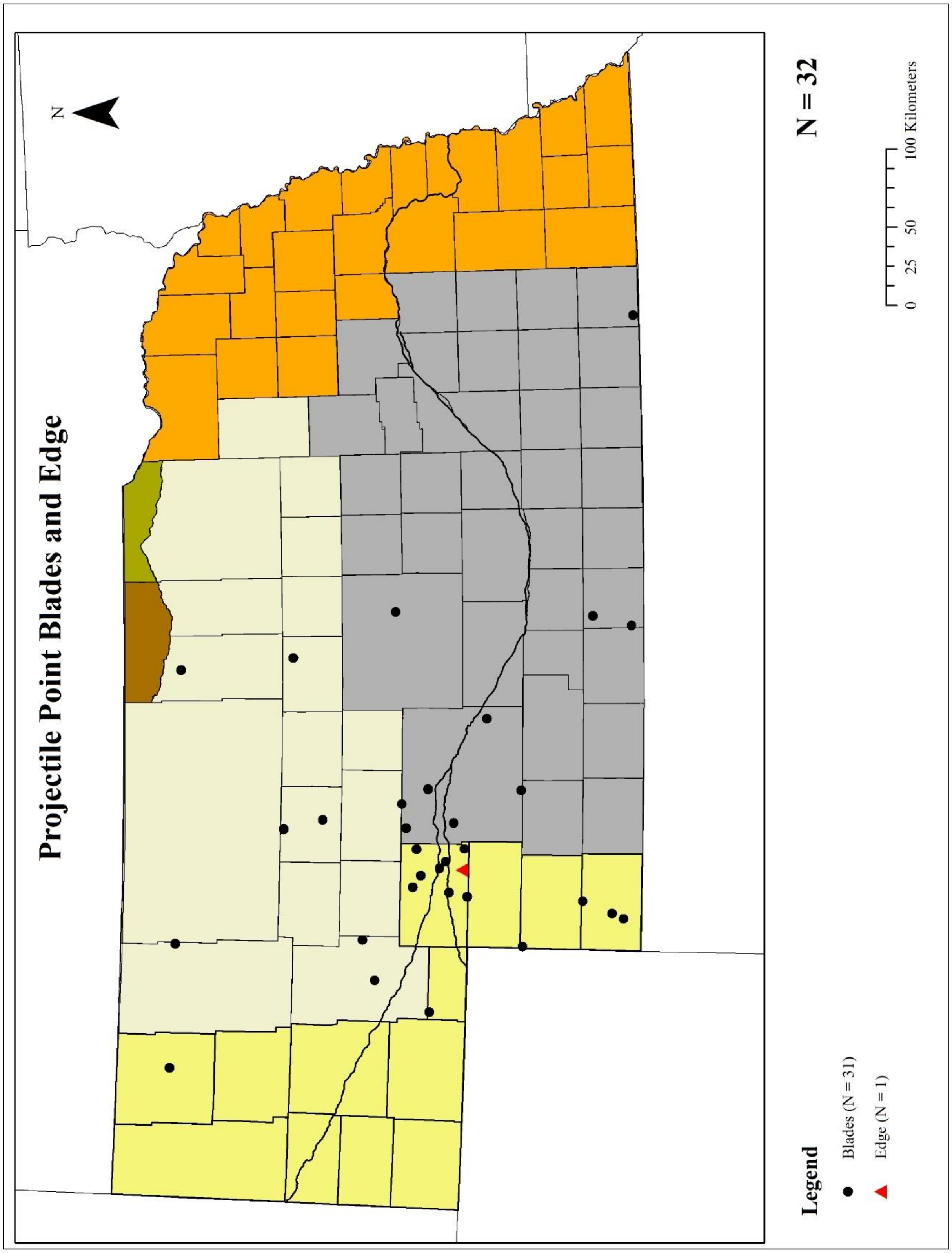

Figure 3.10: Projectile Point Blades and Edge Distribution by Ecoregion

Projectile Point Bases Distribution. Projectile point base is defined here as the concave proximal portion of a Folsom point (although if it has been reworked the base can be straight and not concave). The Folsom evidence in Nebraska includes 85 projectile point bases (Table 3.7). This fragment type occurs in the western half of Nebraska with a secondary concentration along the southern tier of counties (Table 3.7, Figure 3.11). Projectile point bases are more widespread than the projectile point tips distribution. The counties with the most bases are in the confluence of the North and South Platte Rivers. Keith and Lincoln counties have 12 and 15 bases respectively. Other western Nebraska counties with a high number of bases are Chase (10 specimens), Garden (6 specimens), and McPherson (5 specimens); while several other counties in western Nebraska have from one to three bases each. The secondary concentration along the southern tier of counties includes Harlan (6 bases), Franklin (2 bases), Nuckolls (4 bases), Jefferson (2 bases), and Pawnee (1 base) Counties.

Projectile point bases occur in four ecoregions and in both the North and South Platte River streambeds (Table 3.8, Figure 3.12). The evidence for projectile point bases was confined to the western and southern ecoregions of Nebraska. The Central Great Plains is the ecoregion with the highest number of bases (29 bases). Both the Western High Plains and Nebraska Sand Hills also have a large number with 25 and 22 specimens respectively. The South Platte River streambed had seven bases, while the North Platte had only one. The eastern ecoregion of the Corn Belt Plains had one projectile point base and the northeastern ecoregions (the Northwestern Glaciated Plains and Northwestern Great Plains) had no evidence for this fragment type.

The occurrence of point bases could reflect general hunting activity, but are believed to commonly represent the locations of retooling. This may have occurred at camps, processing sites, hunting overlooks, and other locations where retooling of damaged equipment might occur.

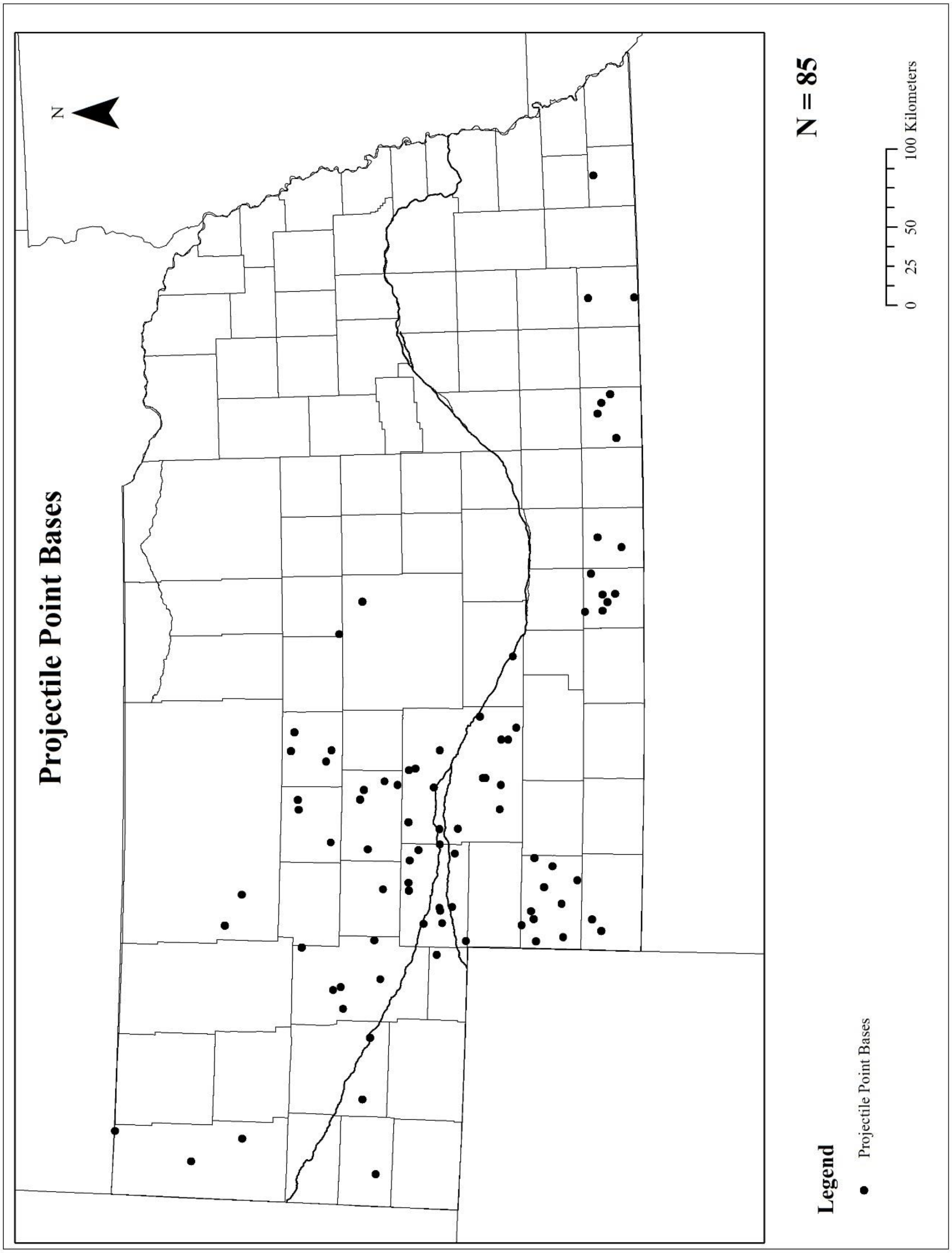

Figure 3.11: Projectile Point Bases Distribution by County

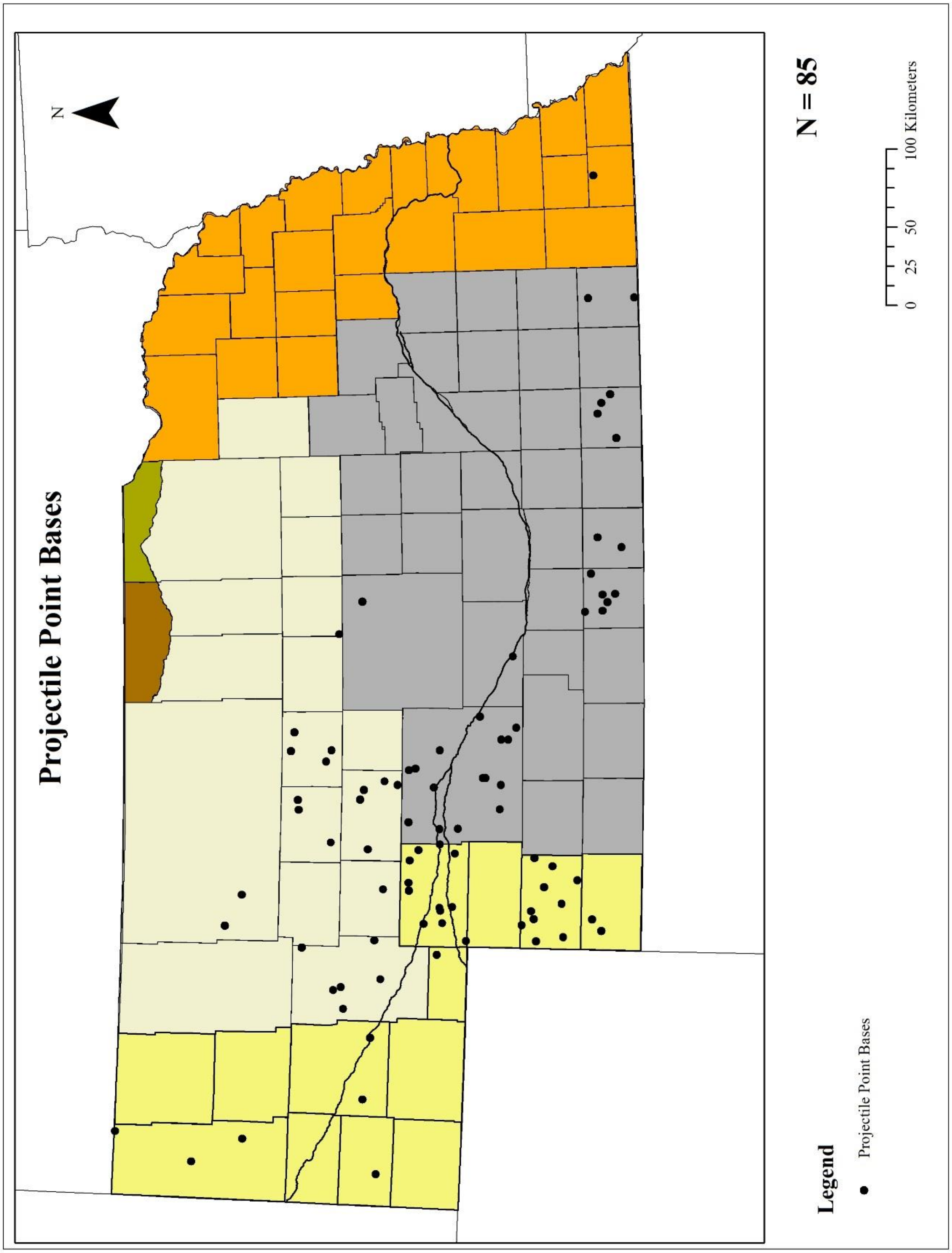

Figure 3.12: Projectile Point Bases Distribution by Ecoregion

Projectile Point Tips Distribution. Projectile point tip is defined here as the distal end of the point. The Nebraska Folsom sample includes 32 projectile point tips (Table 3.7). The projectile point tips sample is less widespread than for projectile point bases. Table 3.7 and Figure 3.13 show the primary concentration for tips is almost exclusively in the counties in and close to the confluence of the North and South Platter Rivers—in Garden (4 tips), Deuel (2 tips), Keith (8 tips), Lincoln (10 tips), McPherson (2 tips), and Chase (3 tips) Counties. The only two counties outside the North and South Platte River region where tips were found are Sioux (one tip) in the northwestern corner of the state and Harlan (2 tips) located in south-central Nebraska.

Projectile point tips occur in three ecoregions and in the South Platte River streambed (Table 3.8, Figure 3.14). The South Platte had 11 tip specimens, while the North Platte had no evidence for this fragment type. The central and western Nebraska ecoregions of the Western High Plains (5 tips), Nebraska Sand Hills (6 tips), and Central Great Plains (10 tips) all had evidence for tips. The eastern and northeastern Nebraska ecoregions of the Corn Belt Plains, Northwestern Glaciated Plains, and Northwestern Great Plains had no evidence for tips.

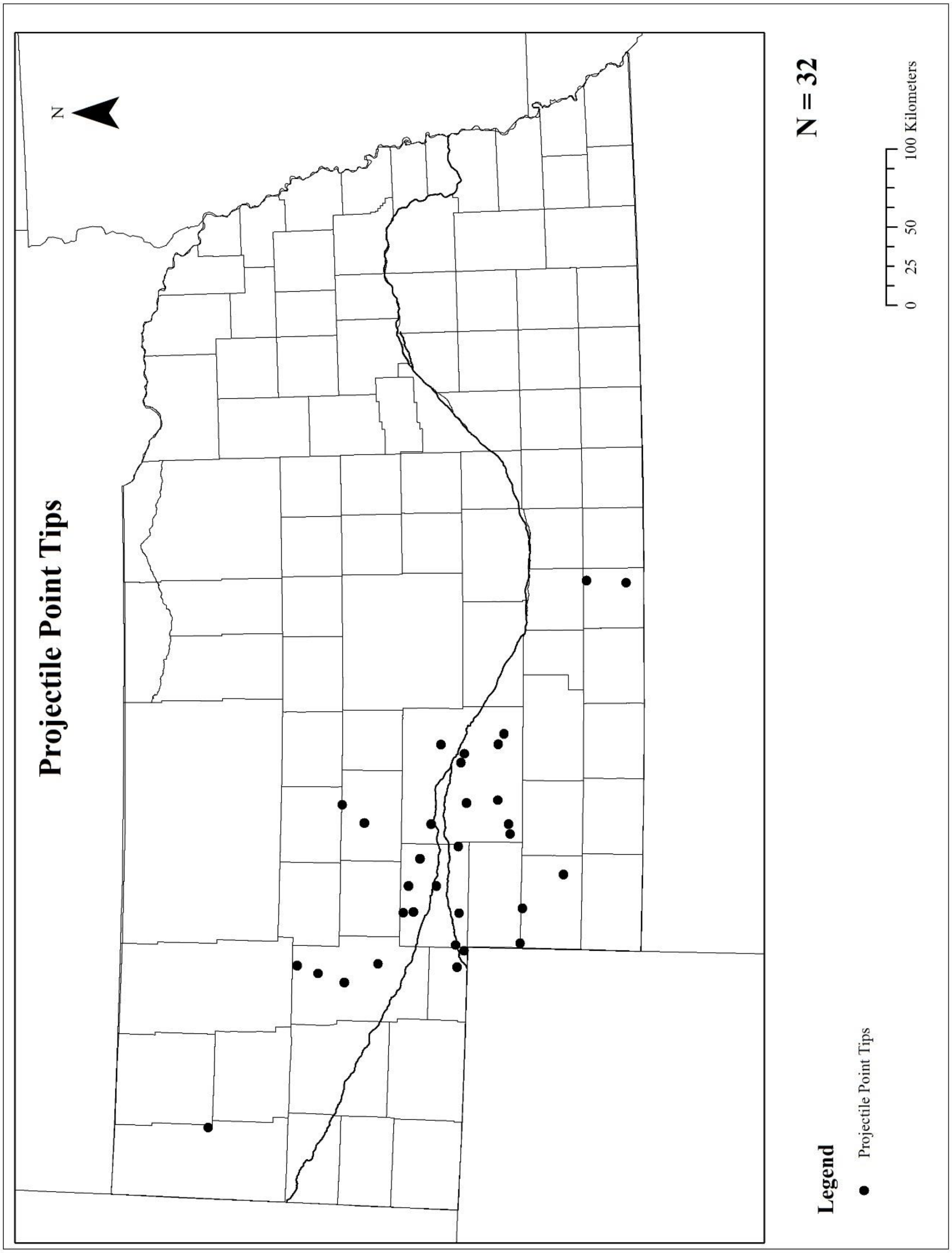

Figure 3.13: Projectile Point Tips Distribution by County

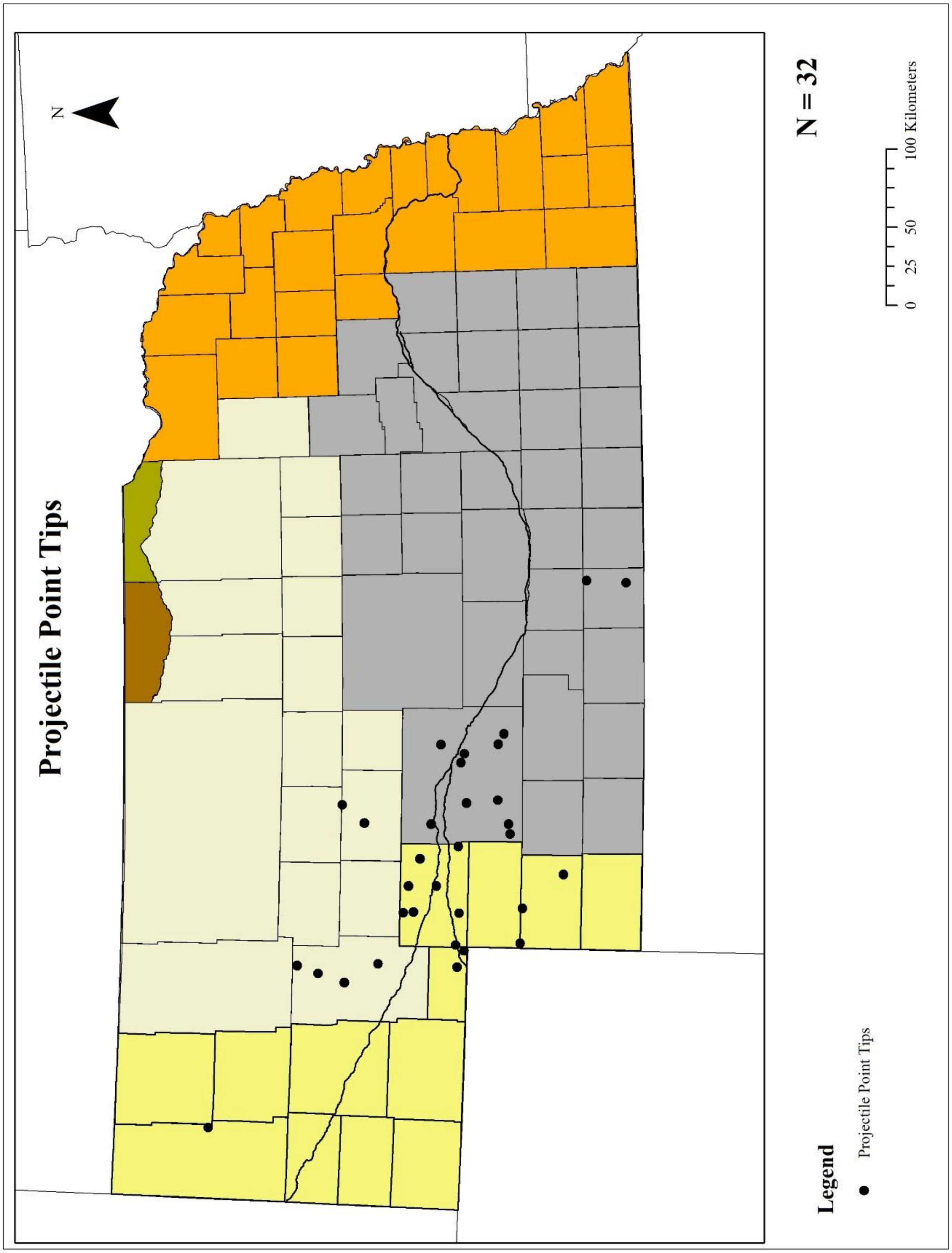

Figure 3.14: Projectile Point Tips Distribution by Ecoregion

Chapter 4: Evaluation of Potential Modern Biases

Before assessing patterns of Folsom artifacts in the Central Plains, it is important to address possible modern sampling biases. This chapter considers four main factors that might contribute bias in the Folsom distribution in the Central Plains. These factors are modern population, contemporary land use practices (i.e. cultivation), archaeological research intensity, and geomorphic factors.

Evaluation of Potential Modern Population Sampling Bias

It is assumed that modern population has the potential to affect the visibility of the Folsom archaeological record. Thus, it is important to consider whether this factor is affecting the Folsom distribution in the Central Plains. Since most artifact collectors hunt most intensively where they live, modern population density of an area should correlate with the number of collectors hunting in that area (c.f. Prasciunas 2008). Therefore, the higher the population, the greater the chances of Folsom artifacts being found in that area, assuming all other factors are equal. The population density for each county in Nebraska was calculated by dividing the total population of each county by the land area per county. Population information for each county with Folsom artifacts in Nebraska was derived from the U.S. Census Bureau using 1950 figures—the time when many of the artifacts in the sample were found and believed to be a better estimate than current population to characterize overall 20th century population. The population for all counties in an ecoregion was added to get the total population per ecoregion. To standardize calculations and control for county and ecoregion sizes Folsom artifact density per county and ecoregion were calculated by dividing the number of Folsom artifacts per county and ecoregion by the total area of the county and ecoregion. Because these densities were small, they were multiplied by 1,000 to get the Folsom artifact occurrence per 1,000 km^2 for each county and ecoregion (cf. Prasciunas 2008:37). The population statistics for each county and ecoregion in Nebraska are presented in Tables 4.1 and 4.2 respectively. It is important to note that artifacts found in the North and South Platte Rivers were included in this analysis and were assigned to an ecoregion based on the county in which they were found.

Pearson's product-moment correlation coefficient was used to determine the relationship between Folsom artifact density and modern population density in each ecoregion. The results of this analysis are presented in Table 4.4. The scale used to interpret Pearson's product-moment correlations is given in Table 4.3. Pearson's could not be calculated for two of the regions (the Northwestern Glaciated Plains and Northwestern Great Plains) because of insufficient sample sizes in these region.

The results revealed small negative correlations in both the Western High Plains and Corn Belt Plains, a medium negative correlation in the Nebraska Sand Hills, and no correlation in the Central Great Plains. But, the associated P values (where $P \leq .05$) revealed the results were not statistically significant in any of these regions. Thus, there does not appear to be a correlation between Folsom artifact density and modern population density for any of the ecoregions in Nebraska. Modern population is not a potential sampling bias for this study.

Table 4.1: Modern Population Statistics for Each Nebraska County

County	Ecoregion	Population per County (in 1950)	County Area (km^2)	Population Density (Population/ County Area)	# Folsom Artifacts*	Folsom Artifact Density (# Folsom Artifacts/ County Area x 1,000)
Adams	Central Great Plains	28,855	1,458	19.79081	0	0.000000
Antelope	Nebraska Sand Hills	11,624	2,220	5.23604	0	0.000000
Arthur	Nebraska Sand Hills	803	1,852	0.43359	2	1.079914
Banner	Western High Plains	1,325	1,932	0.68582	2	1.035197
Blaine	Nebraska Sand Hills	1,203	1,841	0.65345	4	2.172732
Boone	Central Great Plains	10,721	1,779	6.02642	1	0.562114
Box Butte	Western High Plains	12,279	2,784	4.41056	1	0.359195
Boyd	Northwestern Glaciated Plains	4,911	1,399	3.51036	0	0.000000
Brown	Nebraska Sand Hills	5,164	3,162	1.63314	1	0.316256
Buffalo	Central Great Plains	25,134	2,507	10.02553	0	0.000000
Burt	Western Corn Belt Plains	11,536	1,277	9.03367	0	0.000000
Butler	Central Great Plains	11,432	1,513	7.55585	0	0.000000
Cass	Western Corn Belt Plains	16,361	1,448	11.29903	0	0.000000
Cedar	Western Corn Belt Plains	13,843	1,917	7.22118	0	0.000000
Chase	Western High Plains	5,176	2,315	2.23585	32	13.822894
Cherry	Nebraska Sand Hills	8,397	15,439	0.54388	8	0.518168
Cheyenne	Western High Plains	12,081	3,098	3.89961	0	0.000000
Clay	Central Great Plains	8,700	1,484	5.86253	0	0.000000
Colfax	Western Corn Belt Plains	10,010	1,070	9.35514	0	0.000000
Cuming	Western Corn Belt Plains	12,994	1,481	8.77380	0	0.000000
Custer	Central Great Plains	19,170	6,672	2.87320	4	0.599520
Dakota	Western Corn Belt Plains	10,401	684	15.20614	0	0.000000
Dawes	Western High Plains	9,708	3,616	2.68473	1	0.276549
Dawson	Central Great Plains	19,393	2,624	7.39063	2	0.762195
Deuel	Western High Plains	3,330	1,140	2.92105	8	7.017544
Dixon	Western Corn Belt Plains	9,129	1,233	7.40389	0	0.000000
Dodge	Western Corn Belt Plains	26,265	1,383	18.99132	0	0.000000
Douglas	Western Corn Belt Plains	281,020	857	327.91132	0	0.000000
Dundy	Western High Plains	4,354	2,383	1.82711	9	3.776752

Fillmore	Central Great Plains	9,610	1,492	6.44102	0	0.000000
Franklin	Central Great Plains	7,096	1,492	4.75603	2	1.340483
Frontier	Central Great Plains	5,282	2,525	2.09188	0	0.000000
Furnas	Central Great Plains	9,385	1,860	5.04570	0	0.000000
Gage	Western Corn Belt Plains	28,052	2,214	12.67028	0	0.000000
Garden	Nebraska Sand Hills	4,114	4,416	0.93161	15	3.396739
Garfield	Nebraska Sand Hills	2,912	1,476	1.97290	0	0.000000
Gosper	Central Great Plains	2,734	1,186	2.30523	0	0.000000
Grant	Nebraska Sand Hills	1,057	2,010	0.52587	1	0.497512
Greeley	Central Great Plains	5,575	1,476	3.77710	0	0.000000
Hall	Central Great Plains	32,186	1,414	22.76238	1	0.707214
Hamilton	Central Great Plains	8,778	1,409	6.22995	0	0.000000
Harlan	Central Great Plains	7,189	1,432	5.02025	18	12.569832
Hayes	Central Great Plains	2,404	1,847	1.30157	0	0.000000
Hitchcock	Central Great Plains	5,867	1,839	3.19032	1	0.543774
Holt	Nebraska Sand Hills	14,859	6,250	2.37744	0	0.000000
Hooker	Nebraska Sand Hills	1,061	1,867	0.56829	15	8.034280
Howard	Central Great Plains	7,226	1,476	4.89566	0	0.000000
Jefferson	Central Great Plains	13,623	1,484	9.17992	5	3.369272
Johnson	Western Corn Belt Plains	7,251	974	7.44456	0	0.000000
Kearney	Central Great Plains	6,409	1,336	4.79716	0	0.000000
Keith	Western High Plains	7,449	2,748	2.71070	70	25.473071
Keya Paha	Northwestern Great Plains	2,160	2,002	1.07892	0	0.000000
Kimball	Western High Plains	4,283	2,466	1.73682	0	0.000000
Knox	Western Corn Belt Plains	14,820	2,870	5.16376	0	0.000000
Lancaster	Western Corn Belt Plains	119,742	2,173	55.10446	1	0.460193
Lincoln	Central Great Plains	27,380	6,641	4.12287	50	7.528987
Logan	Nebraska Sand Hills	1,357	1,479	0.91751	0	0.000000
Loup	Nebraska Sand Hills	1,348	1,476	0.91328	2	1.355014
Madison	Western Corn Belt Plains	24,338	1,484	16.40027	0	0.000000
McPherson	Nebraska Sand Hills	825	2,225	0.37079	16	7.191011
Merrick	Central Great Plains	8,812	1,256	7.01592	0	0.000000
Morrill	Western High Plains	8,263	3,688	2.24051	4	1.084599
Nance	Central Great Plains	6,512	1,142	5.70228	0	0.000000
Nemaha	Western Corn Belt Plains	10,973	1,059	10.36166	0	0.000000

Nuckolls	Central Great Plains	9,609	1,489	6.45332	7	4.701142
Otoe	Western Corn Belt Plains	17,056	1,595	10.69342	0	0.000000
Pawnee	Western Corn Belt Plains	6,744	1,119	6.02681	1	0.893655
Perkins	Western High Plains	4,809	2,287	2.10275	0	0.000000
Phelps	Central Great Plains	9,048	1,399	6.46748	0	0.000000
Pierce	Western Corn Belt Plains	9,405	1,487	6.32482	0	0.000000
Platte	Central Great Plains	19,910	1,756	11.33827	0	0.000000
Polk	Central Great Plains	8,044	1,137	7.07476	0	0.000000
Red Willow	Central Great Plains	12,977	1,857	6.98815	2	1.077006
Richardson	Western Corn Belt Plains	16,886	1,435	11.76725	0	0.000000
Rock	Nebraska Sand Hills	3,026	2,611	1.15894	0	0.000000
Saline	Central Great Plains	14,046	1,489	9.43318	0	0.000000
Sarpy	Western Corn Belt Plains	15,693	624	25.14904	0	0.000000
Saunders	Western Corn Belt Plains	16,923	1,953	8.66513	0	0.000000
Scotts Bluff	Western High Plains	33,939	1,914	17.73197	1	0.522466
Seward	Central Great Plains	13,155	1,489	8.83479	0	0.000000
Sheridan	Nebraska Sand Hills	9,539	6,322	1.50886	7	1.107245
Sherman	Central Great Plains	6,421	1,466	4.37995	0	0.000000
Sioux	Western High Plains	3,124	5,354	0.58349	5	0.933881
Stanton	Western Corn Belt Plains	6,387	1,114	5.73339	0	0.000000
Thayer	Central Great Plains	10,563	1,489	7.09402	3	2.014775
Thomas	Nebraska Sand Hills	1,206	1,847	0.65295	4	2.165674
Thurston	Western Corn Belt Plains	8,590	1,020	8.42157	0	0.000000
Valley	Central Great Plains	7,252	1,471	4.92998	0	0.000000
Washington	Western Corn Belt Plains	11,511	1,010	11.39703	0	0.000000
Wayne	Western Corn Belt Plains	10,129	1,150	8.80783	0	0.000000
Webster	Central Great Plains	7,395	1,489	4.96642	0	0.000000
Wheeler	Nebraska Sand Hills	1,526	1,489	1.02485	0	0.000000
York	Central Great Plains	14,346	1,492	9.61528	0	0.000000
Total for Nebraska	**NA**	**1,325,510**	**199,106**	**6.65731**	**306**	**1.536870**

*** For purposes of this analysis, all artifacts found in the North and South Platte rivers were counted as being from the county in which they were found.**

Table 4.2: Modern Population Statistics for Each Ecoregion in Nebraska

Ecoregion	Population per Ecoregion (in 1950)	Ecoregion Area (km^2)	Population Density (Population/ Ecoregion Area)	# Folsom Artifacts	Folsom Artifact Density* (# Folsom Artifacts/ Ecoregion Area x 1,000)
Western High Plains	110,120	35,725	3.08244	133	3.722883
Central Great Plains	422,239	67,367	6.26774	96	1.425030
Nebraska Sand Hills	70,021	57,982	1.20763	75	1.293505
Northwestern Glaciated Plains	4,911	1,399	3.51036	0	0.000000
Northwestern Great Plains	2,160	2,002	1.07892	0	0.000000
Corn Belt Plains	716,059	34,631	20.67682	2	0.057752
Totals for Nebraska	1,325,510	199,106	6.65731	306	1.536870
*** For purposes of this analysis, all artifacts found in the North and South Platte rivers were counted as being from the ecoregion in which they were found.**					
**** Pearson's could not be run for these ecoregions because of insufficient sample sizes in these regions.**					

Table 4.3: Pearson's Product-Moment Correlation Scale

Correlation	Negative	Positive
None	-0.09 to 0.0	0.0 to 0.09
Small	-0.3 to -0.1	0.1 to 0.3
Medium	-0.5 to -0.3	0.3 to 0.5
Large	-1.0 to -0.5	0.5 to 1.0

Table 4.4: Results of Pearson's Product-Moment Correlations Between Modern Population Density and Folsom Artifact Density

Ecoregion	Pearsons r	Correlation Explanation	P Value	Statistical Significance
Western High Plains	-0.12207	Small Negative Correlation	0.6912	Results not statistically significant
Central Great Plains	-0.08558	No Correlation	0.6197	Results not statistically significant
Nebraska Sand Hills	-0.37861	Medium Negative Correlation	0.134	Results not statistically significant
Northwestern Glaciated Plains	NA**	NA**	NA**	NA**
Northwestern Great Plains	NA**	NA**	NA**	NA**
Corn Belt Plains	-0.0103	Small Negative Correlation	0.961	Results not statistically significant
Total for State of Nebraska	-0.07258	No Correlation	0.4893	Results not statistically significant
** Pearson's could not be calculated because of insufficient sample sizes in these regions.				

Evaluation of Potential Modern Landuse (Cultivation) Sampling Bias

It is generally assumed that land under cultivation increases the surface visibility of the archaeological record (Lepper 1983:271). According to Prasciunas (2008:37), the greater the amount of land under cultivation in an area, the greater chances that an artifact will be found on the surface. Thus, it is important to consider whether cultivation is a factor affecting the visibility of the archaeological record. For this analysis, Folsom artifacts known to have been found in stream beds were excluded from calculations.

To address whether land under cultivation had a correlation with the Folsom artifact density, I extracted the total acreage of cultivated land, for each Nebraska county with Folsom artifacts, from the U.S. Department of Agriculture 1950 Census of Agriculture. Cultivated acreage was converted into km^2. Then the percent of county area under cultivation was derived by dividing the land area under cultivation by the total county land area. Raw Folsom artifact counts were standardized by converting them to densities (dividing the total number of Folsom artifacts per county by the total county area and multiplying by 1,000) (cf. Prasciunas 2008:37). The total cultivated land for each county, percent of county area under cultivation, and Folsom artifact densities per county are presented in Table 4.5.

The land that was in cultivation for all the counties in each ecoregion was added to get the total cropland area (in km^2) for each ecoregion. The percent of cultivated land was calculated by dividing the total agricultural area (cropland) of each ecoregion and dividing that by the total ecoregion area and multiplying by 100. The total cropland, percent of cultivated land, and non-streambed Folsom artifact density for each ecoregion are presented in Table 4.6. Pearson's product-moment correlations were calculated for each ecoregion to assess whether the percent of cultivated land in each region had a correlation with the Folsom artifact density in each region for artifacts found in non-streambed contexts. I considered only Folsom artifacts found in non-streambed contexts in this analysis, as artifacts that come from active river channels may be independent of landuse—that is, land under cultivation was not a direct factor for visibility of these artifacts.

The results of Pearson's product-moment correlation between the Folsom artifacts from non-streambed contexts and percent of cultivated land in each ecoregion (along with associated P values) are presented in Table 4.7. A scale for Pearson's correlation, which was used to interpret the results, is shown in Table 4.3. Two of the ecoregions (the Northwestern Glaciated Plains and Northwestern Great Plains), did not have adequate sample sizes and therefore Pearson's product-moment correlation could not be calculated for these regions.

The results of the analysis indicated a small negative correlation between the percent of cultivated land and Folsom artifact density in two of the ecoregions (the Western High Plains and Central Great Plains); but, these were not found to be statistically significant. However, for the Nebraska Sand Hills a large negative correlation was found, and in the Corn Belt Plains a medium negative correlation was found. Both of these results were statistically significant (where $P \leq .05$). A significant negative correlation between the percent of cultivated land and Folsom artifact density was found in both these regions. In other words, in the Nebraska Sand Hills and Corn Belt Plains, land with more cultivation was *less* likely to yield Folsom artifacts. One explanation for these results could be that cropland is usually on low terraces where the ages of the surfaces are too young to have Folsom cultural deposits (Mandel 2008). We would expect to find Folsom-aged deposits in the T_2 and higher terraces.

Table 4.5: Total Cropland, Percent Cultivation, and Non-Streambed Folsom Artifact Density per County

County	Ecoregion	Cropland (acres)	Conversion factor	Cropland (km2)	County Area (km^2)	% Cultivated (Cropland /county area x 100)	# Non-streambed Folsom Artifacts*	Folsom Artifact Density (# Non-streambed Artifacts/ County Area x 1,000)
Adams	Central Great Plains	271,685	0.00404686	1,099	1,458	75	0	0.000000
Antelope	Nebraska Sand Hills	368,325	0.00404686	1,491	2,220	67	0	0.000000
Arthur	Nebraska Sand Hills	69,888	0.00404686	283	1,852	15	2	1.079914
Banner	Western High Plains	193,245	0.00404686	782	1,932	40	2	1.035197
Blaine	Nebraska Sand Hills	122,836	0.00404686	497	1,841	27	4	2.172732
Boone	Central Great Plains	300,316	0.00404686	1,215	1,779	68	1	0.562114
Box Butte	Western High Plains	374,953	0.00404686	1,517	2,784	55	1	0.359195
Boyd	Northwestern Glaciated Plains	159,081	0.00404686	644	1,399	46	0	0.000000
Brown	Nebraska Sand Hills	227,833	0.00404686	922	3,162	29	1	0.316256
Buffalo	Central Great Plains	385,914	0.00404686	1,562	2,507	62	0	0.000000
Burt	Western Corn Belt Plains	254,839	0.00404686	1,031	1,277	81	0	0.000000
Butler	Central Great Plains	297,833	0.00404686	1,205	1,513	80	0	0.000000
Cass	Western Corn Belt Plains	273,966	0.00404686	1,109	1,448	77	0	0.000000
Cedar	Western Corn Belt Plains	354,224	0.00404686	1,433	1,917	75	0	0.000000
Chase	Western High Plains	272,963	0.00404686	1,105	2,315	48	32	13.822894
Cherry	Nebraska Sand Hills	668,254	0.00404686	2,704	15,439	18	8	0.518168
Cheyenne	Western High Plains	549,941	0.00404686	2,226	3,098	72	0	0.000000
Clay	Central Great Plains	279,723	0.00404686	1,132	1,484	76	0	0.000000
Colfax	Western Corn Belt Plains	199,438	0.00404686	807	1,070	75	0	0.000000
Cuming	Western Corn Belt Plains	291,823	0.00404686	1,181	1,481	80	0	0.000000
Custer	Central Great Plains	681,197	0.00404686	2,757	6,672	41	4	0.599520
Dakota	Western Corn Belt Plains	124,177	0.00404686	503	684	73	0	0.000000
Dawes	Western High Plains	213,248	0.00404686	863	3,616	24	1	0.276549
Dawson	Central Great Plains	341,978	0.00404686	1,384	2,624	53	2	0.762195
Deuel	Western High Plains	196,083	0.00404686	794	1,140	70	0	0.000000
Dixon	Western Corn Belt Plains	232,271	0.00404686	940	1,233	76	0	0.000000

Dodge	Western Corn Belt Plains	271,092	0.00404686	1,097	1,383	79	0	0.000000
Douglas	Western Corn Belt Plains	140,845	0.00404686	570	857	67	0	0.000000
Dundy	Western High Plains	219,058	0.00404686	886	2,383	37	9	3.776752
Fillmore	Central Great Plains	302,128	0.00404686	1,223	1,492	82	0	0.000000
Franklin	Central Great Plains	196,506	0.00404686	795	1,492	53	2	1.340483
Frontier	Central Great Plains	262,225	0.00404686	1,061	2,525	42	0	0.000000
Furnas	Central Great Plains	272,476	0.00404686	1,103	1,860	59	0	0.000000
Gage	Western Corn Belt Plains	403,251	0.00404686	1,632	2,214	74	0	0.000000
Garden	Nebraska Sand Hills	240,284	0.00404686	972	4,416	22	15	3.396739
Garfield	Nebraska Sand Hills	115,206	0.00404686	466	1,476	32	0	0.000000
Gosper	Central Great Plains	150,292	0.00404686	608	1,186	51	0	0.000000
Grant	Nebraska Sand Hills	87,423	0.00404686	354	2,010	18	1	0.497512
Greeley	Central Great Plains	182,808	0.00404686	740	1,476	50	0	0.000000
Hall	Central Great Plains	231,764	0.00404686	938	1,414	66	1	0.707214
Hamilton	Central Great Plains	284,144	0.00404686	1,150	1,409	82	0	0.000000
Harlan	Central Great Plains	216,117	0.00404686	875	1,432	61	18	12.569832
Hayes	Central Great Plains	200,489	0.00404686	811	1,847	44	0	0.000000
Hitchcock	Central Great Plains	226,095	0.00404686	915	1,839	50	1	0.543774
Holt	Nebraska Sand Hills	665,635	0.00404686	2,694	6,250	43	0	0.000000
Hooker	Nebraska Sand Hills	31,900	0.00404686	129	1,867	7	15	8.034280
Howard	Central Great Plains	197,179	0.00404686	798	1,476	54	0	0.000000
Jefferson	Central Great Plains	244,703	0.00404686	990	1,484	67	1	0.673854
Johnson	Western Corn Belt Plains	161,629	0.00404686	654	974	67	0	0.000000
Kearney	Central Great Plains	244,916	0.00404686	991	1,336	74	0	0.000000
Keith	Western High Plains	270,402	0.00404686	1,094	2,748	40	18	6.550218
Keya Paha	Northwestern Great Plains	164,836	0.00404686	667	2,002	33	0	0.000000
Kimball	Western High Plains	386,914	0.00404686	1,566	2,466	63	0	0.000000
Knox	Western Corn Belt Plains	425,907	0.00404686	1,724	2,870	60	0	0.000000
Lancaster	Western Corn Belt Plains	390,969	0.00404686	1,582	2,173	73	1	0.460193
Lincoln	Central Great Plains	527,838	0.00404686	2,136	6,641	32	33	4.969131
Logan	Nebraska Sand Hills	99,053	0.00404686	401	1,479	27	0	0.000000
Loup	Nebraska Sand Hills	87,905	0.00404686	356	1,476	24	2	1.355014
Madison	Western Corn Belt Plains	284,216	0.00404686	1,150	1,484	78	0	0.000000
McPherson	Nebraska Sand Hills	126,265	0.00404686	511	2,225	23	10	4.494382
Merrick	Central Great Plains	214,028	0.00404686	866	1,256	69	0	0.000000

Morrill	Western High Plains	242,449	0.00404686	981	3,688	27	3	0.813449
Nance	Central Great Plains	182,264	0.00404686	738	1,142	65	0	0.000000
Nemaha	Western Corn Belt Plains	194,185	0.00404686	786	1,059	74	0	0.000000
Nuckolls	Central Great Plains	244,083	0.00404686	988	1,489	66	2	1.343183
Otoe	Western Corn Belt Plains	313,510	0.00404686	1,269	1,595	80	0	0.000000
Pawnee	Western Corn Belt Plains	163,543	0.00404686	662	1,119	59	1	0.893655
Perkins	Western High Plains	416,961	0.00404686	1,687	2,287	74	0	0.000000
Phelps	Central Great Plains	248,412	0.00404686	1,005	1,399	72	0	0.000000
Pierce	Western Corn Belt Plains	260,800	0.00404686	1,055	1,487	71	0	0.000000
Platte	Central Great Plains	332,588	0.00404686	1,346	1,756	77	0	0.000000
Polk	Central Great Plains	220,236	0.00404686	891	1,137	78	0	0.000000
Red Willow	Central Great Plains	257,864	0.00404686	1,044	1,857	56	2	1.077006
Richardson	Western Corn Belt Plains	243,366	0.00404686	985	1,435	69	0	0.000000
Rock	Nebraska Sand Hills	199,533	0.00404686	807	2,611	31	0	0.000000
Saline	Central Great Plains	275,904	0.00404686	1,117	1,489	75	0	0.000000
Sarpy	Western Corn Belt Plains	113,834	0.00404686	461	624	74	0	0.000000
Saunders	Western Corn Belt Plains	392,086	0.00404686	1,587	1,953	81	0	0.000000
Scotts Bluff	Western High Plains	246,884	0.00404686	999	1,914	52	1	0.522466
Seward	Central Great Plains	289,097	0.00404686	1,170	1,489	79	0	0.000000
Sheridan	Nebraska Sand Hills	416,486	0.00404686	1,685	6,322	27	7	1.107245
Sherman	Central Great Plains	182,766	0.00404686	740	1,466	50	0	0.000000
Sioux	Western High Plains	128,320	0.00404686	519	5,354	10	5	0.933881
Stanton	Western Corn Belt Plains	194,036	0.00404686	785	1,114	70	0	0.000000
Thayer	Central Great Plains	260,563	0.00404686	1,054	1,489	71	2	1.343183
Thomas	Nebraska Sand Hills	65,727	0.00404686	266	1,847	14	4	2.165674
Thurston	Western Corn Belt Plains	186,356	0.00404686	754	1,020	74	0	0.000000
Valley	Central Great Plains	188,266	0.00404686	762	1,471	52	0	0.000000
Washington	Western Corn Belt Plains	195,874	0.00404686	793	1,010	78	0	0.000000
Wayne	Western Corn Belt Plains	241,087	0.00404686	976	1,150	85	0	0.000000
Webster	Central Great Plains	226,730	0.00404686	918	1,489	62	0	0.000000
Wheeler	Nebraska Sand Hills	126,810	0.00404686	513	1,489	34	0	0.000000
York	Central Great Plains	293,286	0.00404686	1,187	1,492	80	0	0.000000
Total for Nebraska	**NA**	**23,776,438**	**NA**	**96,220**	**199,106**	**48**	**212**	**1.064759**

***Only Folsom artifacts from non-streambed contexts were used for all calculations**.

Table 4.6: Total Cropland, Percent Cultivation, and Non-Streambed Folsom Artifact Density by Ecoregion

Ecoregion	Cropland (acres)	Conversion factor	Cropland (km2)	Ecoregion Area (km^2)	% Cultivated (Cropland / Ecoregion Area x 100)	# Non-streambed Folsom Artifacts*	Folsom Artifact Density* (# Non-streambed Folsom Artifacts/ Ecoregion Area x 1,000)
Western High Plains	3,711,421	0.00404686	15,020	35,725	42	71	1.987404
Central Great Plains	9,714,413	0.00404686	39,313	67,367	58	69	1.024240
Nebraska Sand Hills	3,719,363	0.00404686	15,052	57,982	26	69	1.190024
Northwestern Glaciated Plains	159,081	0.00404686	644	1,399	46	0	0.000000
Northwestern Great Plains	164,836	0.00404686	667	2,002	33	0	0.000000
Corn Belt Plains	6,307,324	0.00404686	25,525	34,631	74	2	0.057752
Totals for Nebraska	23,776,438	NA	96,220	199,106	48	211	1.059737

*** Only Folsom artifacts from non-streambed contexts were used for these calculations.**

Table 4.7: Pearson's Product-Moment Correlations Between Percent of Cultivated Land and Non-Streambed Folsom Artifact Density by Ecoregion

Ecoregion	Pearson's r	Correlation Explanation	P Value	Statistical Significance
Western High Plains	-0.14202	Small Negative Correlation	0.6434	Results not statistically significant
Central Great Plains	-0.20279	Small Negative Correlation	0.2355	Results not statistically significant
Nebraska Sand Hills	-0.53812	Large Negative Correlation	0.0259	Statistically significant; $P \leq .05$; There is a significant negative correlation between the % of cultivated land and Folsom artifact density in this ecoregion. 95% chance that factors other than chance are responsible for these results; 5% probability of these results occurring by chance.
Northwestern Glaciated Plains	NA**	NA**	NA**	NA**
Northwestern Great Plains	NA**	NA**	NA**	NA**
Corn Belt Plains	-0.46842	Medium Negative Correlation	0.0182	Statistically significant; $P \leq .05$; There is a significant negative correlation between the % of cultivated land and Folsom artifact density in this ecoregion. 95% chance that factors other than chance are responsible for these results; 5% probability of these results occurring by chance.
Total for the state of Nebraska	-0.32216	Medium Negative Correlation	0.0016	Results not statistically significant

** Pearson's could not be calculated because of the insufficient sample sizes in these regions.

Evaluation of the Potential Bias of Archaeological Research Intensity

Archaeological research intensity is often considered a potential bias in artifact distribution studies because it is assumed that the greater the archaeological research conducted in an area, the higher likelihood that artifacts and sites will be recorded in the area. This potential bias was assessed by examining the total number of archaeological sites (excavated and surface sites) from all time periods reported per county. Then all the archaeological sites were added for all the counties in each ecoregion to get the total number of archaeological sites per ecoregion. I obtained the total number of archaeological sites from all time periods in each county from the Nebraska State Historical Society (personal communication, Trisha Nelson, January 15, 2014). The Nebraska State Historical Society distinguishes a site "by placing a spatial limit on the defined or observable material remains of former human behavior that created the remains. What constitutes adequate spatial segregation between artifactual material in order to designate a site or multiple sites is not specifically defined here beyond the exercise of common sense" (pp. 22, Nebraska State Historic Preservation Office, Section 106 Guidelines, May 22, 2006). The Nebraska State Historical Society treats isolated archaeological finds the same as scatters and features—in that all get a site number (personal communication Trisha Nelson, March 3, 2015). However, "prehistoric isolated finds (i.e., single artifacts), which are clearly in a secondary induced context (e.g., stream-eroded, artificially moved, etc.) will not be given site status…All other isolated finds which are or may be due to primary or secondary human (direct or indirect) action will be accounted for by assigning them a site number" (pp. 22, Nebraska State Historic Preservation Office, Section 106 Guidelines, May 22, 2006). The archaeological sites recorded by the Nebraska State Historical Society include sites turned in by avocational archaeologists, professional archaeological surveys, and incidental documentation. It is assumed that the number of overall sites corresponds to the intensity of professional archaeological involvement by people who would recognize diagnostic Folsom artifacts. All things being equal, intensity of site reporting is used here as an approximation of intensity of archaeological documentation.

Archaeological research intensity was determined by taking the total number of recorded sites per ecoregion divided by the total ecoregion area. To standardize calculations and control for county and ecoregion sizes Folsom artifact densities were calculated by dividing the number of Folsom artifacts per county and ecoregion by the total area of the county and ecoregion, respectively. Because these densities were small, they were multiplied by 1,000 to get the Folsom artifact occurrence per 1,000 km^2 in each county and ecoregion (cf., Prasciunas 2008:37). The total number of recorded archaeological sites, archaeological research intensity, and Folsom artifact density per county and ecoregion are presented in Tables 4.8 and 4.9, respectively. It is important to note that artifacts found in the North and South Platte were included in this analysis and assigned to an ecoregion based on the county in which they were found.

Pearson's product-moment correlations were calculated to determine the relationship between archaeological research intensity and Folsom artifact density for each ecoregion. The goal was to assess sampling bias based on modern archaeological activity. The results of the correlations are presented in Table 4.10 (and as for the two previous analyses, a scale used for interpreting Pearson's product-moment correlations can be seen in Table 4.3). For two of the ecoregions (the Northwestern Glaciated Plains and Northwestern Great Plains) Pearson's correlations could not be calculated because of the insufficient sample sizes in these regions. There was a small positive correlation in the Central Great Plains, and no correlations in all three of the remaining regions of the Western High Plains, Nebraska Sand Hills, and Corn Belt Plains.

For all ecoregions, the results were not statistically significant (where $P \leq .05$). For all regions, no significant correlation exists between archaeological research intensity and Folsom artifact density. Archaeological research intensity does not appear to be a potential sampling bias in this study. It should be noted that many of the Folsom artifacts reported here are not from recorded sites, but instead are isolates, or streambed finds. This is not believed to be a key factor in the results presented here.

Table 4.8: Total Number of Recorded Archaeological Sites, Archaeological Research Intensity, and Folsom Artifact Density Per County

County Name	Ecoregion*	Total Recorded Archy Sites per County	County Area (km^2)	Arch. Research Intesity (Total Recorded Sites per County/ County Area)	# of Folsom artifacts	Folsom Artifact Density (# Folsom Artifacts/ County Area x 1,000)
Adams	Central Great Plains	33	1,458	0.022634	0	0.000000
Antelope	Nebraska Sand Hills	83	2,220	0.037387	0	0.000000
Arthur	Nebraska Sand Hills	0	1,852	0.000000	2	1.079914
Banner	Western High Plains	27	1,932	0.013975	2	1.035197
Blaine	Nebraska Sand Hills	33	1,841	0.017925	4	2.172732
Boone	Central Great Plains	59	1,779	0.033165	1	0.562114
Box Butte	Western High Plains	17	2,784	0.006106	1	0.359195
Boyd	Northwestern Glaciated Plains	222	1,399	0.158685	0	0.000000
Brown	Nebraska Sand Hills	135	3,162	0.042694	1	0.316256
Buffalo	Central Great Plains	212	2,507	0.084563	0	0.000000
Burt	Corn Belt Plains	98	1,277	0.076742	0	0.000000
Butler	Central Great Plains	66	1,513	0.043622	0	0.000000
Cass	Corn Belt Plains	368	1,448	0.254144	0	0.000000
Cedar	Corn Belt Plains	99	1,917	0.051643	0	0.000000
Chase	Western High Plains	104	2,315	0.044924	32	13.822894
Cherry	Nebraska Sand Hills	311	15,439	0.020144	8	0.518168
Cheyenne	Western High Plains	144	3,098	0.046482	0	0.000000
Clay	Central Great Plains	60	1,484	0.040431	0	0.000000
Colfax	Corn Belt Plains	72	1,070	0.067290	0	0.000000
Cuming	Corn Belt Plains	25	1,481	0.016880	0	0.000000
Custer	Central Great Plains	149	6,672	0.022332	4	0.599520
Dakota	Corn Belt Plains	70	684	0.102339	0	0.000000
Dawes	Western High Plains	397	3,616	0.109790	1	0.276549
Dawson	Central Great Plains	120	2,624	0.045732	2	0.762195
Deuel	Western High Plains	22	1,140	0.019298	8	7.017544
Dixon	Corn Belt Plains	157	1,233	0.127332	0	0.000000
Dodge	Corn Belt Plains	71	1,383	0.051338	0	0.000000
Douglas	Corn Belt Plains	231	857	0.269545	0	0.000000
Dundy	Western High Plains	19	2,383	0.007973	9	3.776752

Fillmore	Central Great Plains	40	1,492	0.026810	0	0.000000
Franklin	Central Great Plains	79	1,492	0.052949	2	1.340483
Frontier	Central Great Plains	353	2,525	0.139802	0	0.000000
Furnas	Central Great Plains	239	1,860	0.128495	0	0.000000
Gage	Corn Belt Plains	217	2,214	0.098013	0	0.000000
Garden	Nebraska Sand Hills	97	4,416	0.021966	15	3.396739
Garfield	Nebraska Sand Hills	16	1,476	0.010840	0	0.000000
Gosper	Central Great Plains	106	1,186	0.089376	0	0.000000
Grant	Nebraska Sand Hills	3	2,010	0.001493	1	0.497512
Greeley	Central Great Plains	54	1,476	0.036585	0	0.000000
Hall	Central Great Plains	106	1,414	0.074965	1	0.707214
Hamilton	Central Great Plains	40	1,409	0.028389	0	0.000000
Harlan	Central Great Plains	167	1,432	0.116620	18	12.569832
Hayes	Central Great Plains	26	1,847	0.014077	0	0.000000
Hitchcock	Central Great Plains	36	1,839	0.019576	1	0.543774
Holt	Nebraska Sand Hills	58	6,250	0.009280	0	0.000000
Hooker	Nebraska Sand Hills	46	1,867	0.024638	15	8.034280
Howard	Central Great Plains	97	1,476	0.065718	0	0.000000
Jefferson	Central Great Plains	66	1,484	0.044474	5	3.369272
Johnson	Corn Belt Plains	35	974	0.035934	0	0.000000
Kearney	Central Great Plains	23	1,336	0.017216	0	0.000000
Keith	Western High Plains	183	2,748	0.066594	70	25.473071
Keya Paha	Northwestern Great Plains	188	2,002	0.093906	0	0.000000
Kimball	Western High Plains	43	2,466	0.017437	0	0.000000
Knox	Corn Belt Plains	145	2,870	0.050523	0	0.000000
Lancaster	Corn Belt Plains	238	2,173	0.109526	1	0.460193
Lincoln	Central Great Plains	87	6,641	0.013100	50	7.528987
Logan	Nebraska Sand Hills	0	1,479	0.000000	0	0.000000
Loup	Nebraska Sand Hills	55	1,476	0.037263	2	1.355014
Madison	Corn Belt Plains	37	1,484	0.024933	0	0.000000
McPherson	Nebraska Sand Hills	3	2,225	0.001348	16	7.191011
Merrick	Central Great Plains	34	1,256	0.027070	0	0.000000
Morrill	Western High Plains	190	3,688	0.051518	4	1.084599
Nance	Central Great Plains	166	1,142	0.145359	0	0.000000
Nemaha	Corn Belt Plains	107	1,059	0.101039	0	0.000000

Nuckolls	Central Great Plains	84	1,489	0.056414	7	4.701142
Otoe	Corn Belt Plains	172	1,595	0.107837	0	0.000000
Pawnee	Corn Belt Plains	107	1,119	0.095621	1	0.893655
Perkins	Western High Plains	16	2,287	0.006996	0	0.000000
Phelps	Central Great Plains	29	1,399	0.020729	0	0.000000
Pierce	Corn Belt Plains	7	1,487	0.004707	0	0.000000
Platte	Central Great Plains	118	1,756	0.067198	0	0.000000
Polk	Central Great Plains	50	1,137	0.043975	0	0.000000
Red Willow	Central Great Plains	48	1,857	0.025848	2	1.077006
Richardson	Corn Belt Plains	156	1,435	0.108711	0	0.000000
Rock	Nebraska Sand Hills	21	2,611	0.008043	0	0.000000
Saline	Central Great Plains	106	1,489	0.071189	0	0.000000
Sarpy	Corn Belt Plains	454	624	0.727564	0	0.000000
Saunders	Corn Belt Plains	232	1,953	0.118792	0	0.000000
Scotts Bluff	Western High Plains	158	1,914	0.082550	1	0.522466
Seward	Central Great Plains	81	1,489	0.054399	0	0.000000
Sheridan	Nebraska Sand Hills	43	6,322	0.006802	7	1.107245
Sherman	Central Great Plains	71	1,466	0.048431	0	0.000000
Sioux	Western High Plains	669	5,354	0.124953	5	0.933881
Stanton	Corn Belt Plains	53	1,114	0.047576	0	0.000000
Thayer	Central Great Plains	77	1,489	0.051713	3	2.014775
Thomas	Nebraska Sand Hills	33	1,847	0.017867	4	2.165674
Thurston	Corn Belt Plains	82	1,020	0.080392	0	0.000000
Valley	Central Great Plains	68	1,471	0.046227	0	0.000000
Washington	Corn Belt Plains	162	1,010	0.160396	0	0.000000
Wayne	Corn Belt Plains	26	1,150	0.022609	0	0.000000
Webster	Central Great Plains	44	1,489	0.029550	0	0.000000
Wheeler	Nebraska Sand Hills	5	1,489	0.003358	0	0.000000
York	Central Great Plains	39	1,492	0.026139	0	0.000000
Total for Nebraska	**NA**	**9995**	**199,106**	**0.050199**	**306**	**1.536870**

***For purposes of this analysis, all artifacts found in the North and South Platte rivers were counted as being from the county in which they were found.**

Table 4.9: Total Number of Recorded Archaeological Sites, Archaeological Research Intensity, and Folsom Artifact Density Per Ecoregion

Ecoregion*	Total # Recorded Arch. Sites per Ecoregion	Ecoregion Area (km^2)	Arch. Research Intensity (Total Recorded Sites per Ecoregion/ Ecoregion Area)	# of Folsom artifacts	Folsom Artifact Density (# Folsom Artifacts/ Ecoregion Area x 1,000)
Western High Plains	1,989	35,725	0.055675	133	3.722883
Central Great Plains	3,233	67,367	0.047991	96	1.425030
Nebraska Sand Hills	942	57,982	0.016246	75	1.293505
Northwestern Glaciated Plains	222	1,399	0.158685	0	0.000000
Northwestern Great Plains	188	2,002	0.093906	0	0.000000
Corn Belt Plains	3,421	34,631	0.098784	2	0.057752
Totals for Nebraska	9,995	199,106	0.050199	306	1.536870
*** For purposes of this analysis, all artifacts found in the North and South Platte rivers were counted as being from the ecoregion in which they were found.**					
**** Pearson's could not calculated because of insufficient sample sizes in these regions.**					

Table 4.10: Pearson’s Product-Moment Correlations Between Archaeological Research Intensity and Folsom Artifact Density

Ecoregion	Pearsons r	Correlation Explanation	P Value	Statistical Significance
Western High Plains	0.06784	No Correlation	0.8257	Results not statistically significant
Central Great Plains	0.14598	Small Positive Correlation	0.3956	Results not statistically significant
Nebraska Sand Hills	0.02792	No Correlation	0.9153	Results not statistically significant
Northwestern Glaciated Plains	NA**	NA**	NA**	NA**
Northwestern Great Plains	NA**	NA**	NA**	NA**
Corn Belt Plains	-0.03225	No Correlation	0.8784	Results not statistically significant
Total for State of Nebraska	-0.06872	No Correlation	0.5128	Results not statistically significant
**** Pearson's could not be calculated because of the insufficient sample sizes in these regions.**				

Evaluation of Potential Geomorphic Factors Sampling Bias

Geomorphic factors such as terrace formation in alluvial valleys, loess deposition, sand dunes, and associated erosion in the Holocene since Folsom time all have the potential to bias the Folsom distribution in this study. Each are briefly considered herein.

Alluvial Valleys. The size of the T-1 terraces in the Central Plains, and in particular along the large Platte River system, impact the potential for Folsom surface finds. The low T-1 terraces occupy thousands of acres in some counties and this impacts the potential for finding surface Folsom artifacts and could essentially bias the Folsom distribution in this study. This is because the ages of these geomorphic surfaces are too young to contain Folsom-age sites. If Folsom-age artifacts are found on the T-1 terraces, then they were introduced by later peoples (for example the Folsom projectile point excavated from a ceramic-age site trash pit in Hall County). Given knowledge of the alluvial stratigraphy of the Central Plains, we can expect that there will not be any Folsom-age artifacts on the low T-1 terraces—the potential to find Folsom artifacts on these young surfaces should be very low. Therefore, the large area that T-1 terraces occupy in alluvial valleys can affect the Folsom distribution in the Central Plains.

However, rivers have a high potential for attracting animals, and therefore the people that hunt those animals, and they also provide critical sources of water, wood, and other resources. We would expect to find Folsom artifacts on the T-2 terraces, gravel bars, and flood plains. The Folsom activity and artifacts on the river bottom/flood plains is probably not just a derivative of reworked material out of T_2 terraces. Many of the artifacts found in the river channel probably started out in the river channel, but just upstream. The gravel bars, the river channels, may have been good places for Folsom groups to camp because the reason to be in the channels is high because of water, wood, lithics, protection, and animals. The number of artifacts that come out of river channels is high. This is likely because the gravel bars, the flood plains are going to be targets for seasonal occupation by Folsom groups and others. The gravel bars are good for seasonal, not all year round, occupation because obviously one would not want to be in the river channel and flood plain if it's flooding.

Schultz et al. (1951:30) were the first to give a detailed valley evolution model for Nebraska. This model revealed the stratigraphic position where Paleoindian cultural deposits could be found. At the Lime Creek site, charcoal recovered approximately 40 feet below the surface of the T-2 terrace fill yielded a radiocarbon age of 10, 493 ± 1,500 yrs B.P (Bamforth 2002; Holen and May 2002; Schultz et al. 1951:34). This radiocarbon age is important because it indicates that Folsom cultural deposits could occur at great depths in the Terrace 2A fill in Schultz's valley evolution model for Nebraska. There has been a variety of work that has dated Folsom-age cultural deposits in the T-2 terraces of the Central Plains. For example, soil organic matter from buried paleosols in the Elba terrace fill located at Cooper's Canyon on the North Loup River yielded radiocarbon ages between ca. 11,000 and 9,000 RCYBP (May 1990). Also, Mandel (2008:352) obtained an age of 10,340 ± 100 RCYBP from the upper 10 cm of Soil 9 in the T-2 terrace fill from Locality 44, a high-order stream locality on the Little Blue River in southeastern Nebraska. Therefore, in alluvial settings there are landscapes that date to Folsom time in the Central Plains, but they are deeply buried in the T-2 terraces—they will not be found on the modern land surface. Where are we going to find Folsom period archaeological sites preserved in the Central Plains? Mandel (2008) reported that we are going to find Folsom period archaeological sites preserved in high-order streams throughout the region, in alluvial fans, and in draws on the High Plains of western Kansas.

Folsom people may have occupied gravel bars and their artifacts may have remained in the channel through the Holocene. However, Folsom age finds will not be found on the low terraces of alluvial systems as these surfaces are too young to contain Folsom-age deposits. Alluvial valleys are one of the geomorphic factors that can affect the distribution of Folsom artifacts in this study.

Sand Hills. The sand in this region is wind deposited and wind activated. Sand dunes were very active during the late Holocene (Bettis et al. 2003) and this has buried or exposed a lot of the Folsom-age record. Even given this fact, we do find Folsom artifacts in the Sand Hills. Folsom artifacts do occur in the Sand Hills. The fact that Clovis and Folsom artifacts are found there (Figures 4.1 and 4.2) would suggest that not all of the Paleoindian sites are buried (Holen and Hofman 1999). The current Folsom and Clovis distributions in the Sand Hills suggests there are exposures in the region and that we need more systematic documentation there.

Climatic and Vegetative changes that led to Erosion and Deposition in the Holocene since Folsom time. During the early Holocene and continuing through the mid-Holocene, climatic and vegetative changes occurred that led to erosion and deposition since Folsom time. The Altithermal climatic episode, a period of time when drier and warmer conditions prevailed, occurred from approximately 8,000 to 5,000 RCYBP (Antevs 1955; Bryson et al. 1970; Deevy and Flint 1957; Greiser 1985; Mandel 1995; Webb and Bryson 1972). During the early Holocene, fewer but more erosive and powerful thunderstorms occurred in the middle of the continent (Knox 1983:34). During the Altithermal, a change in prairies occurred, from tall- and mixed-grass to short grass prairies. This led to uplands being prone to erosion at this time (Kutzbach 1987; Mandel 2006). Additionally, it is probable that during this period, frequent fires eliminated ground cover and thus increased erosion on hillslopes (Mandel 1995). The effect of the vegetative and climatic changes that occurred during the early- through mid-Holocene led to erosion on the uplands that occurred at a high rate. This large upland sediment yield was transported to streams “where it was deposited on alluvial fans and floodplains resulting in deep burial of Paleoindian-age landscapes” (Mandel 2008:359). Therefore, landscapes that date to the Folsom period exist; however, it is likely that erosion has removed at least some of it, or deposition has buried it. It is also likely that deflation has exposed Folsom-age deposits in some upland settings. Also, in northeastern Nebraska, because of significant erosion on uplands, lower elevation Folsom-age surfaces may be buried. This is probably the reason why we have found no stratified Folsom archaeological sites in Nebraska. Instead, our window into the Folsom record is limited to surface diagnostic Folsom artifacts in this region.

Loess Deposition. Northeastern, eastern, and south-central areas of Nebraska have thick deposits of loess on the uplands. This loess deposition and re-deposition could potentially bury Folsom artifacts. The Pleistocene Peoria loess is quite thick (up to 50 meters) and accumulated across the Great Plains region from ca. 23,000 cal yrs. B.P. until about 12,000 cal yrs. B.P (Bettis et al. 2003; Holen and May 2002; Forman and Pierson 2002; May and Holen 1993, 2003, 2005; Muhs et al. 1999). Therefore, Peoria loess deposition ended by about Folsom time (i.e., calibrated radiocarbon ages for Folsom are 12,900–12,000 cal yrs. B.P) and therefore should not greatly interfere with the visibility of the Folsom record. In some places, Bignell loess buried the Peoria and is much thinner (usually less than 2 meters) and accumulated in episodes throughout the entire Holocene. However it did not accumulate throughout the Great Plains region (Bettis et al. 2003; Maat and Johnson 1996; Martin 1993; Mason and Kuzila 2000; Mason et al. 2002; Muhs et al. 1999; Pye et al. 1995). Therefore, the Bignell loess buried some of the upland surfaces that potentially could have Folsom-age sites. However, considerable wind and water erosion has occurred in these same settings hence many of the uplands do have exposures. Many Folsom sites and artifacts, even in the higher elevations of uplands could be buried, but there is also the chance for re-exposure through erosion. Therefore, we cannot assume that all of the Folsom record is buried, nor that it is evenly or consistently exposed.

The northeastern, eastern, and south central part of Nebraska (the Northwestern Glaciated Plains, Corn Belt Plains, and Central Great Plains ecoregions) have some of the best Folsom-age surface exposure potential in the state. In other words the surfaces are about the right age for Folsom in these areas (personal communication, Rolfe Mandel, 3-1-12). Therefore, if Folsom people were in northeastern, eastern, and south central Nebraska, we should find Folsom artifacts on the surface. Eastern Nebraska has had a lot of loess deposition and also a lot of erosion. Clovis surface artifacts have been found throughout eastern Nebraska (Holen 2003), so we should expect that these same surfaces would have Folsom-age artifacts exposed if Folsom people were there.

Comparison of Clovis versus Folsom Distributions in Nebraska

To compare the distribution of Clovis versus Folsom in Nebraska figures for Clovis by county were obtained from Holen 2001 and 2003. The number of Clovis versus Folsom by county and ecoregion are present in Tables 4.11 and 4.12. If we compare Clovis and Folsom for the state of Nebraska, we see that the distributions are quite different. Figures 4.1 and 4.2 show the distribution for Clovis and Folsom respectively. In two ecoregions, the Northwestern Glaciated Plains and Northwestern Great Plains, no Clovis and Folsom artifacts were found (Table 4.12). In all other ecoregions except one, the Folsom artifact count was greater than for Clovis. However, in the Corn Belt Plains the Clovis artifact county was greater than for Folsom. We see an opposite pattern for Clovis versus Folsom in this ecoregion than seen in the rest of the state.

Adjusted chi-square statistics were used to compare Clovis versus Folsom per ecoregion. This analysis was used to test whether a statistically significant difference exists when the number of Clovis is compared to the number of Folsom at the 95% confidence level ($\alpha = .05$). The results of adjusted chi-square are shown in Table 4.13. The results show a significant difference between the Clovis and Folsom artifact distributions in all ecoregions.

By comparing the distributions we see that Clovis artifacts are well-represented in eastern Nebraska (Holen 2001, 2003), while the Folsom distribution is very limited in this part of the state. In general, a broader and more even distribution exists for Clovis than for Folsom throughout the Plains (Blackmar 2001; Hofman and Hesse 2002). Therefore, we see the lack of Folsom evidence in the northeastern part of Nebraska is not because of a lack of archaeological research and documentation of Paleoindian collections in this area.

The absence of Folsom artifacts in northeast Nebraska is a striking pattern. Perhaps the Folsom sites are buried or perhaps Folsom people were using the landscape differently than Clovis people. I do not argue that bison were not in northeastern Nebraska. There is evidence of Holocene bison and bison kills in northeastern Nebraska (Logan Creek site) and sites near the area in northwestern Iowa (Simonsen and Cherokee Sewer sites) (Anderson and Semken 1980; Hoyer 1980; Mandel 1995; Widga 2006). In northeastern Nebraska, radiocarbon ages determined on charcoal from stratified cultural deposits at the Logan Creek site were ca. 7,300 to 6,000 ^{14}C yr. B.P. (Mandel 1995). Thus, there is evidence for deeply buried cultural deposits and bison kills in this area during the Holocene. However, if bison were in northeastern Nebraska during Folsom times, maybe this was not the best place to hunt them in terms of the landscape, or it is possible that bison were not as accessible in this area as compared to southern and western Nebraska.

Evaluating whether modern factors are biasing the Folsom artifact sample is enhanced by examining artifacts of a similar age (i.e., Clovis) and seeing whether they exhibit the same pattern. If modern population, land use, archaeological research activity, or geomorphic factors are influencing the Folsom distribution, they can be expected to also influence the Clovis distribution. But, we find significant differences between the Clovis and Folsom artifact distributions in all ecoregions in Nebraska. Therefore, much of the Folsom distribution pattern we are seeing may actually be attributable to behaviors of Folsom people.

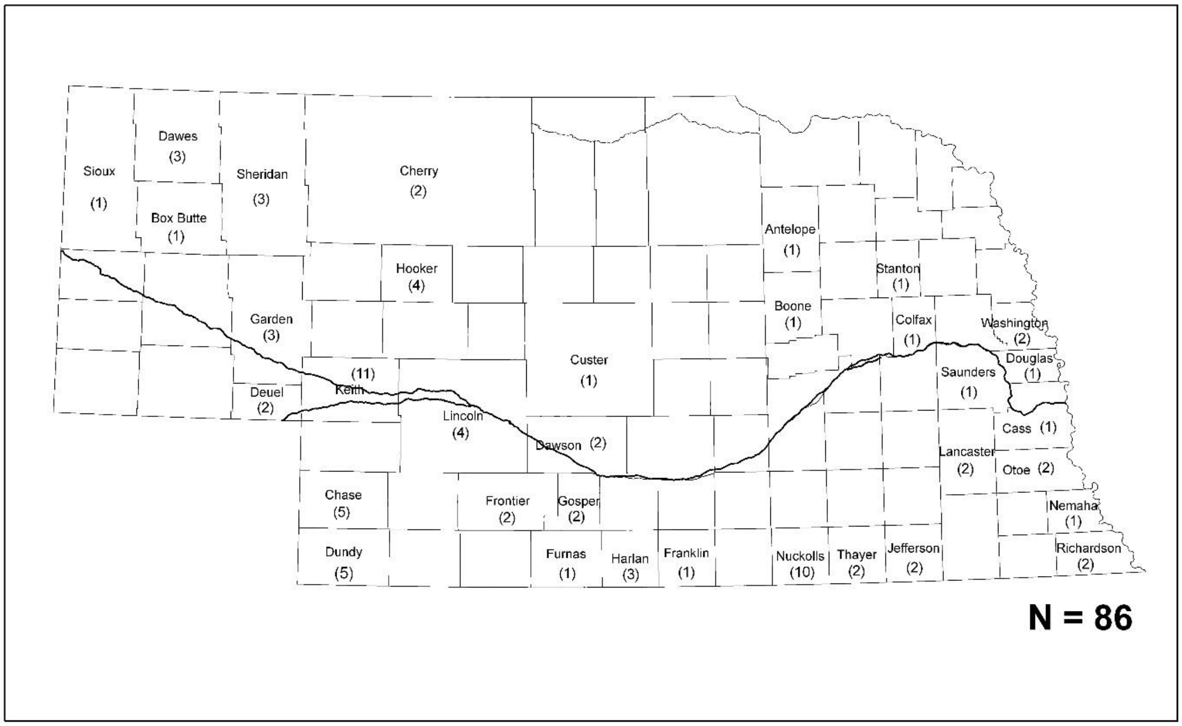

Figure 4.1: Clovis Distribution in Nebraska. Figure adapted from Holen's 2003 Clovis distribution study

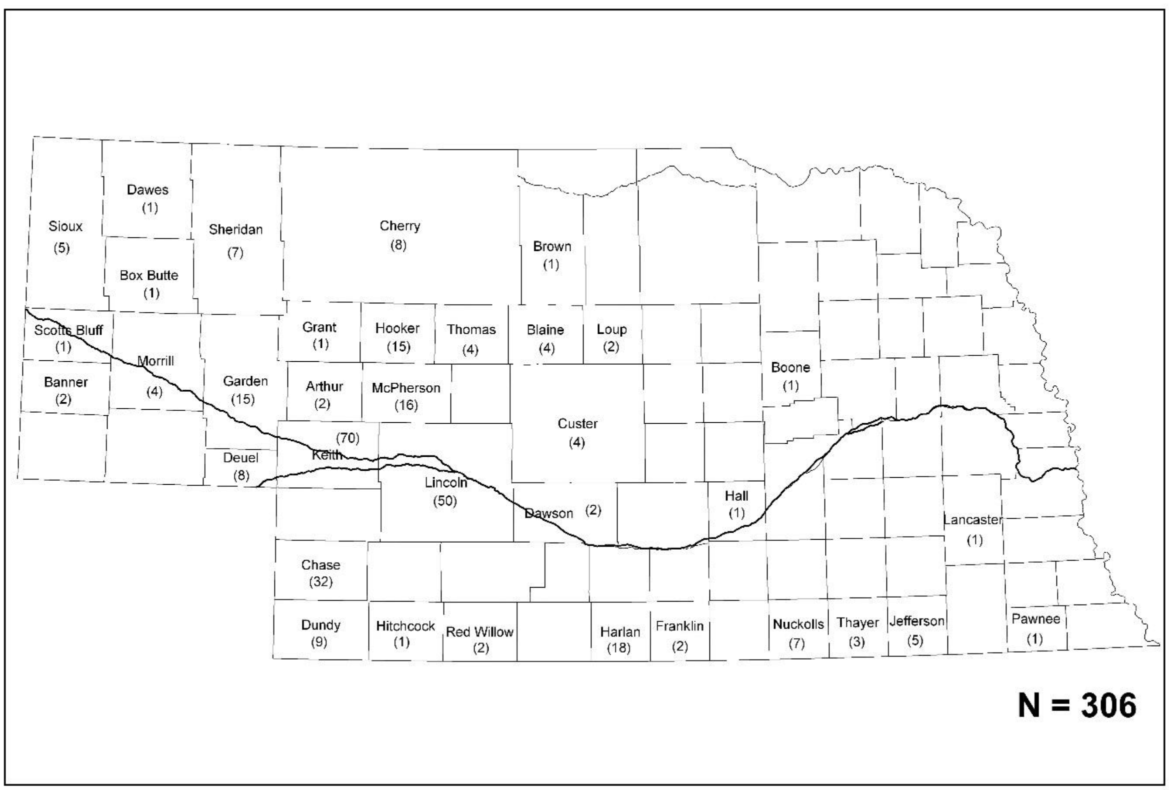

Figure 4.2: Folsom Distribution in Nebraska

Table 4.11: Number of Clovis versus Folsom Artifacts Per County and Ecoregion

County	Ecoregion	# Clovis Artifacts	# Folsom Artifacts*
Adams	Central Great Plains	0	0
Antelope	Nebraska Sand Hills	1	0
Arthur	Nebraska Sand Hills	0	2
Banner	Western High Plains	0	2
Blaine	Nebraska Sand Hills	0	4
Boone	Central Great Plains	1	1
Box Butte	Western High Plains	1	1
Boyd	Northwestern Glaciated Plains	0	0
Brown	Nebraska Sand Hills	0	1
Buffalo	Central Great Plains	0	0
Burt	Corn Belt Plains	0	0
Butler	Central Great Plains	0	0
Cass	Corn Belt Plains	1	0
Cedar	Corn Belt Plains	0	0
Chase	Western High Plains	5	32
Cherry	Nebraska Sand Hills	2	8
Cheyenne	Western High Plains	0	0
Clay	Central Great Plains	0	0
Colfax	Corn Belt Plains	1	0
Cuming	Corn Belt Plains	0	0
Custer	Central Great Plains	1	4
Dakota	Corn Belt Plains	0	0
Dawes	Western High Plains	3	1
Dawson	Central Great Plains	2	2
Deuel	Western High Plains	2	8
Dixon	Corn Belt Plains	0	0
Dodge	Corn Belt Plains	0	0
Douglas	Corn Belt Plains	1	0
Dundy	Western High Plains	5	9
Fillmore	Central Great Plains	0	0
Franklin	Central Great Plains	1	2
Frontier	Central Great Plains	2	0
Furnas	Central Great Plains	1	0
Gage	Corn Belt Plains	0	0
Garden	Nebraska Sand Hills	3	15
Garfield	Nebraska Sand Hills	0	0
Gosper	Central Great Plains	2	0
Grant	Nebraska Sand Hills	0	1

Greeley	Central Great Plains	0	0
Hall	Central Great Plains	0	1
Hamilton	Central Great Plains	0	0
Harlan	Central Great Plains	3	18
Hayes	Central Great Plains	0	0
Hitchcock	Central Great Plains	0	1
Holt	Nebraska Sand Hills	0	0
Hooker	Nebraska Sand Hills	4	15
Howard	Central Great Plains	0	0
Jefferson	Central Great Plains	2	5
Johnson	Corn Belt Plains	0	0
Kearney	Central Great Plains	0	0
Keith	Western High Plains	11	70
Keya Paha	Northwestern Great Plains	0	0
Kimball	Western High Plains	0	0
Knox	Corn Belt Plains	0	0
Lancaster	Corn Belt Plains	2	1
Lincoln	Central Great Plains	4	50
Logan	Nebraska Sand Hills	0	0
Loup	Nebraska Sand Hills	0	2
Madison	Corn Belt Plains	0	0
McPherson	Nebraska Sand Hills	0	16
Merrick	Central Great Plains	0	0
Morrill	Western High Plains	0	4
Nance	Central Great Plains	0	0
Nemaha	Corn Belt Plains	1	0
Nuckolls	Central Great Plains	10	7
Otoe	Corn Belt Plains	2	0
Pawnee	Corn Belt Plains	0	1
Perkins	Western High Plains	0	0
Phelps	Central Great Plains	0	0
Pierce	Corn Belt Plains	0	0
Platte	Central Great Plains	0	0
Polk	Central Great Plains	0	0
Red Willow	Central Great Plains	0	2
Richardson	Corn Belt Plains	2	0
Rock	Nebraska Sand Hills	0	0
Saline	Central Great Plains	0	0
Sarpy	Corn Belt Plains	0	0
Saunders	Corn Belt Plains	1	0
Scotts Bluff	Western High Plains	0	1

Seward	Central Great Plains	0	0
Sheridan	Nebraska Sand Hills	3	7
Sherman	Central Great Plains	0	0
Sioux	Western High Plains	1	5
Stanton	Corn Belt Plains	1	0
Thayer	Central Great Plains	2	3
Thomas	Nebraska Sand Hills	0	4
Thurston	Corn Belt Plains	0	0
Valley	Central Great Plains	0	0
Washington	Corn Belt Plains	2	0
Wayne	Corn Belt Plains	0	0
Webster	Central Great Plains	0	0
Wheeler	Nebraska Sand Hills	0	0
York	Central Great Plains	0	0
Total for Nebraska	**NA**	**86**	**306**
*** For purposes of this analysis, all artifacts found in the North and South Platte rivers were counted as being from the county and ecoregion in which they were found.**			

Table 4.12: Total Number of Clovis Versus Folsom Artifacts Per Ecoregion

Ecoregion*	# Clovis Artifacts	# Folsom Artifacts*
Western High Plains	28	133
Central Great Plains	31	96
Nebraska Sand Hills	13	75
Northwestern Glaciated Plains	0	0
Northwestern Great Plains	0	0
Corn Belt Plains	14	2
Totals for Nebraska	**86**	**306**
*** For purposes of this analysis, all artifacts found in the North and South Platte rivers were counted as being from the county and ecoregion in which they were found.**		

Table 4.13: Clovis versus Folsom Adjusted Chi-Square Results

Ecoregion	Clovis	Folsom	Adjusted χ^2	Tabulated χ^2
Central Great Plains	31	96	33.24*	3.84
Nebraska Sand Hills	13	75	43.64*	3.84
Corn Belt Plains	14	2	8.86*	3.84
Western High Plains	28	133	68.46*	3.84
Total Nebraska	86	306	123.46*	3.84

χ^2 tabulated at $\alpha = 0.05$ and 1 degree of freedom = 3.84

*Significant at 5% level of significance (95% confidence interval)

Conclusion about Potential Modern Sampling Biases

The take away message from examining the potential of modern factors which may influence the Folsom distribution in the Central Plains is that some appear to be potential biases (geomorphic factors such as alluvial valleys), while others do not (modern land use, modern population, and archaeological research intensity). We are seeing a pattern in the Folsom distribution that is apparently independent of land use, modern population, and archaeological research activity.

The patterns in the Central Plains Folsom sample are probably independent of geomorphic factors. We find artifacts in the uplands, in river gravels, sand dunes, and eroded loess surfaces. All kinds of landscapes are represented except Holocene terrace surfaces—and we don't expect to see Folsom-age artifacts here because these terraces are too young for Folsom. The Folsom distribution does not appear to have much to do with potential modern biases, and thus the pattern we are seeing is likely to be, at least in part, about actual Folsom behavior.

The Folsom distribution in the Central Plains does not have a statistically significant correlation with modern population, land use, or archaeological research activity; and is likely independent of geomorphic factors such as sand dunes, loess deposition, and Holocene deposition and erosion that occurred since Folsom time. Since the modern biases do not seem to be the driving determinants of the Central Plains Folsom dataset patterns or distribution that we see, a reason exists to investigate the patterns and distribution further.

Chapter 5: Pattern Recognition in the Data: Lithic Materials and Reduction Stages

Introduction

A small fraction of the Central Plains Folsom dataset is composed of minor lithic material types (i.e., Alibates, Knife River Flint, Edwards chert, Porcelanite, and Tongue River Silicified Sediment). The sample also includes Fossil Wood and Permian chert as minority lithics represented in the dataset. Because of the lithic material samples in the Central Plains Folsom dataset this chapter focuses on the three main material types represented (i.e., White River Group Silicates, Hartville Uplift chert, and Smoky Hill Jasper) in terms of looking at distributions and patterning of reduction stages.

White River Group Silicates (WRGS): Overall Patterns

Because of the overlap in color between sources of White River Group Silicates (WRGS), it is impossible to determine the specific source of some WRGS macroscopically. In these cases neutron activation analysis must be used (Hoard et al. 1991, Holen 2001,). Flattop Butte is the closest source for WRGS for nearly all artifacts in the Nebraska Folsom sample, therefore this source was used to determine distances. Distances were calculated from the material source to the center of the county where the artifacts were found. Other sources of WRGS include Table Mountain, Wyoming and White Horse Creek, South Dakota (Hannus 1985; Koch and Miller 1996). WRGS also washes out in residual gravels (Ahler 1977). The Flattop Butte source is located west of Sterling in northeastern Colorado and WRGS was moved in a northeastern, eastern, and southeastern direction into western Nebraska (Figure 5.2). The maximum distance moved from the source was 395 km into Franklin County in south-central Nebraska. The shortest distance was 97 km into Morrill County (Table 5.5). The mean distance (from the source to the center of the county) for all WRGS artifacts was 187 km (Table 5.5).

A total of 96 WRGS artifacts are in the Nebraska Folsom sample (Figure 5.1) which comprises 31.4% of the total sample. The artifact types for the WRGS sample consists of 67 Folsom points, 8 Midland points, 15 preforms, and 6 channel flakes (Table 5.1). The total number of WRGS Midland and Folsom projectile points is 75 and these are assigned to the following fragment types: 36 complete points and 19 point bases, 10 tips, and 10 blades (Table 5.2).

The greatest frequency of WRGS is found in the counties located in the confluence area of the North and South Platte Rivers in Keith and Lincoln Counties with 26 and 15 specimens respectively for a total of 41 WRGS artifacts found in these two counties (Table 5.3, Figure 5.2). Table 5.3 and Figure 5.2 show the majority of the WRGS evidence is in western Nebraska with Chase (19 artifacts), Dundy (6 artifacts), Garden (5 artifacts), and McPherson (8 artifacts) Counties having the most WRGS evidence outside the North and South Platte River confluence. Two counties in south-central Nebraska have a few WRGS artifacts (Harlan with three and Franklin with one). The eastern and northeastern portions of Nebraska are void of WRGS Folsom evidence.

WRGS artifacts are found in three ecoregions and the South Platte River streambed (Tables 5.4 and 5.6; Figure 5.3). The western and south central Nebraska ecoregions are well represented by WRGS evidence. The Western High Plains has 31 WRGS artifacts, Nebraska Sand Hills has 22, and Central Great Plains has 12 (Table 5.4). The South Platte River has 31 WRGS artifacts. No WRGS artifacts were found in the eastern and northeastern ecoregions of the Corn Belt Plains, Northwestern Great Plains, and Northwestern Glaciated Plains.

White River Group Silicates (WRGS): Patterns in Reduction Stages

White River Group Silicates Preforms. Table 5.5 and Figure 5.2 show the WRGS preform sample includes a total of 15 preforms from four counties (Keith, Lincoln, Chase, and Hooker). All these counties are located in western Nebraska with the highest concentration in Keith and Lincoln Counties at the confluence of the North and South Platte River, with five WRGS preforms in each county. The next highest preform evidence is in Chase County with four WRGS preforms, and lastly Hooker County had one. The distance from the source ranged from 159 to 233 km, with a mean distance of 188 km (Table 5.5).

Table 5.6 and Figure 5.3 show that the 15 WRGS preforms came from three ecoregions (the Western High Plains with 4, Nebraska Sand Hills with 1, and Central Great Plains with 1). The South Platte River had the most preforms with nine. No WRGS preforms were found in the North Platte River nor the eastern and northeastern ecoregions (the Corn Belt Plains, Northwestern Glaciated Plains, and Northwestern Great Plains).

White River Group Silicates (WRGS) Channel Flakes. The Nebraska Folsom sample contains a total of six WRGS channel flakes from three counties (Chase, Keith, and Lincoln). Table 5.5 and Figure 5.2 show that Chase County, located in southwest Nebraska east of the Flattop Butte source area, had four WRGS channel flakes. Keith and Lincoln Counties have one WRGS channel flake each, and as mentioned these encompass the confluence of the North and South Platte Rivers. The WRGS channel flakes from Chase County are from the Nolan site and are located 159 km from the Flattop Butte source (Table 5.5). The ones from Keith and Lincoln Counties are located 159 km and 233 km from the source respectively. The mean distance for WRGS channel flakes from the source to the center of each county was 171 km (Table 5.5). The evidence for WRGS channel flakes was from one ecoregion (the Western High Plains with four) and the South Platte River with two channel flakes (Table 5.6 and Figure 5.3). This is within the area of WRGS Folsom preform occurrences. No evidence for WRGS channel flakes exists in the eastern and northeastern part of the state.

All 4 WRGS channels from Chase County are from the Nolan site. The WRGS channel from Keith County is from a private collection, while the one from Lincoln County is from a different private collection. It is fair to ask the question—whether the evidence for channel flakes in this area is because of sampling bias. We might expect the distribution of channel flakes to mirror that of Folsom preforms, but channel flakes are less recognizable to most collectors and archaeologists.

White River Group Silicates Non-Reworked Projectile Points. The Nebraska Folsom sample contained a total of 26 WRGS non-reworked points (Table 5.5, Figure 5.2). The county with the largest number of WRGS non-reworked points is Keith County with nine specimens. Chase, Lincoln and McPherson Counties have 4, 4, and 3 non-reworked points, respectively. The remaining evidence for non-reworked points is found in Dundy, Garden, Harlan, Hitchcock, Sheridan, and Thomas Counties, each having one specimen. All of these counties lie in western Nebraska with the exception of south-centrally located Harlan County. The distance from the Flattop Butte source area to the WRGS non-reworked points found in the western Nebraska counties ranged between 125 and 270 km (Table 5.5). The maximum distance for the WRGS non-reworked sample was the specimen from Harlan County found 357 km from the source. The mean distance for the WRGS non-reworked points was 192 km (Table 5.5).

Table 5.6 and Figure 5.3 show WRGS non-reworked points occur in three ecoregions and the South Platte River. The South Platte River had the most evidence for WRGS non-reworked points with 9 specimens, while the Nebraska Sand Hills had 6, Western High Plains had 6, and the Central Great Plains had 5. Non-reworked points were not found in the North Platte nor in the eastern and northeastern ecoregions (i.e., the Corn Belt Plains, Northwestern Glaciated Plains, and Northwestern Great Plains).

White River Group Silicates Reworked Projectile Points. The Nebraska Folsom sample has 23 WRGS reworked points. Table 5.5 and Figure 5.2 show the largest number of WRGS reworked points were found in Chase (3 specimens), Dundy (4 specimens), Keith (4 specimens), Lincoln (3 specimens) and McPherson (3 specimens) Counties. All of these counties are in western Nebraska with Keith and Lincoln lying at the confluence of the North and South Platte Rivers. A sparse scattering of reworked points are found in Deuel (1 specimen), Garden (1 specimen), Hooker (1 specimen), and Sheridan (2 specimens) Counties. These counties also lie in western Nebraska. The only county with evidence for reworked points which is outside of western Nebraska is Harlan County with one specimen (located in south-central Nebraska). The reworked points from western Nebraska are between 101 and 233 kilometers from the Flattop Butte source in northeastern Colorado (Table 5.5). The maximum distance for the WRGS reworked point sample was the specimen from Harlan County, in south-central Nebraska, which was found 357 km from the source. However, the mean distance for the WRGS reworked points was 190 km (Table 5.5)

Table 5.6 and Figure 5.3 show that reworked points occur in three ecoregions and the South Platte River. The ecoregions with the greatest number of WRGS reworked points are the Western High Plains (seven specimens) and Nebraska Sand Hills (seven artifacts). The South Platte River both had six reworked points, while the south-centrally located Central Great Plains had three WRGS reworked points.

White River Group Silicates Undetermined (or Indeterminate) Projectile Points. Table 5.5 and Figure 5.2 show the Nebraska Folsom sample contains 26 WRGS undetermined points (in terms of reworking). The largest number of WRGS undetermined points were found in Keith County with seven specimens (Table 5.5, Figure 5.2). Chase County had 4 WRGS undetermined points, Garden had 3, and Lincoln, McPherson and Morrill had 2 each. In Arthur, Dundy, Franklin, Harlan, Hooker, and Sheridan Counties there is one specimen in each. All of the counties where WRGS undetermined points are found are in western Nebraska, with the exception of Harlan and Franklin Counties located in south-central Nebraska. The distance, from the source area to the WRGS undetermined points found in the western Nebraska counties, ranged between 97 and 233 km (Table 5.5). The maximum distance where WRGS undetermined points were found from the source area was in Harlan and Franklin Counties located 357 and 395 km from the source respectively. The mean distance for WRGS undetermined points was 182 km (Table 5.5).

Table 5.6 and Figure 5.3 show that WRGS undetermined points occur in 3 ecoregions and the South Platte River. The Western High Plains had the most evidence for WRGS undetermined points with 10 specimens, the Nebraska Sand Hills had 8 specimens, South Platte River had 5, and the Central Great Plains had 3. No WRGS undetermined points were found in the North Platte nor in the eastern and northeastern ecoregions (i.e. the Corn Belt Plains, Northwestern Glaciated Plains, and Northwestern Great Plains).

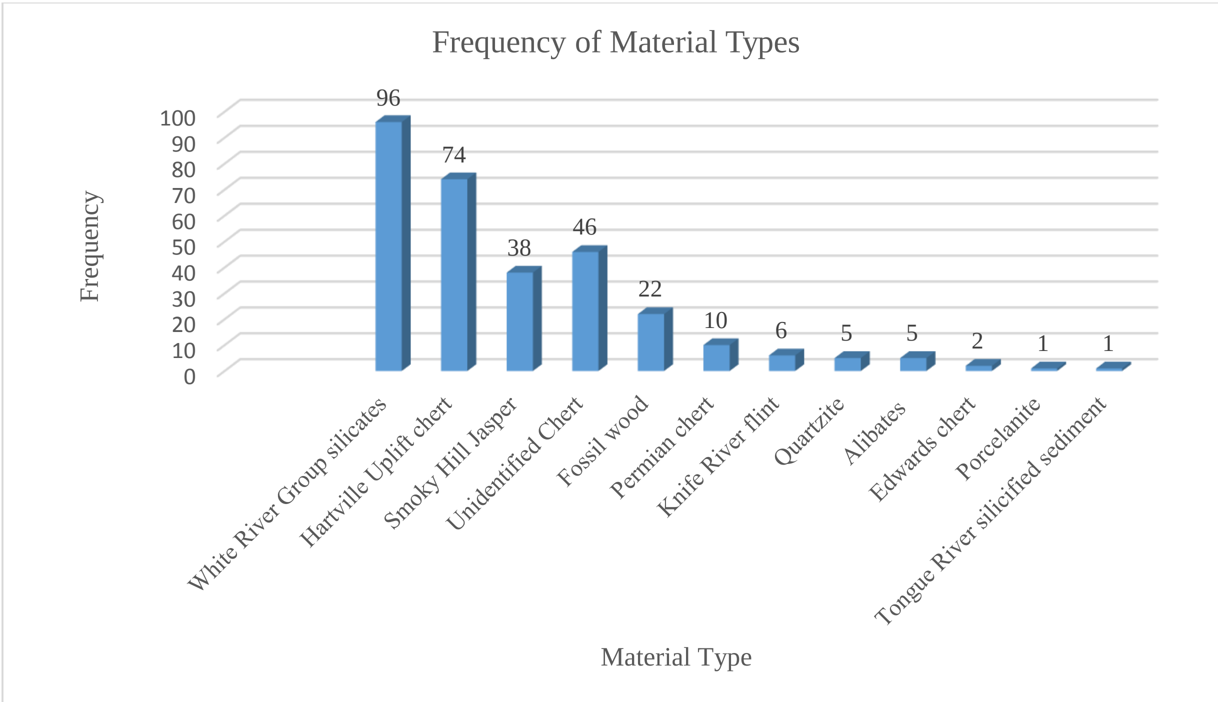

Figure 5.1: Frequency of Material Types

Table 5.1: Artifact Type by Lithic Material

LITHIC MATERIAL SOURCE	ARTIFACT TYPE				TOTALS	% of TOTAL
	FOLSOM POINTS	MIDLAND POINTS	PREFORMS	CHANNELS		
WHITE RIVER GROUP SILICATES	67	8	15	6	**96**	**31.4%**
HARTVILLE UPLIFT CHERT	54	7	11	2	**74**	**24.2%**
SMOKY HILL JASPER	24	4	10	0	**38**	**12.4%**
PERMIAN CHERT	7	0	3	0	**10**	**3.3%**
UNIDENTIFIED CHERT	39	4	3	0	**46**	**15.0%**
FOSSIL WOOD	14	3	4	1	**22**	**7.2%**
QUARTZITE	5	0	0	0	**5**	**1.6%**
KNIFE RIVER FLINT	5	1	0	0	**6**	**2.0%**
ALIBATES AGATIZED DOLOMITE	3	2	0	0	**5**	**1.6%**
PORCELANITE	0	1	0	0	**1**	**0.3%**
EDWARDS CHERT	1	0	1	0	**2**	**0.7%**
TONGUE RIVER SILICIFIED SEDIMENT	0	0	1	0	**1**	**0.3%**
TOTALS	**219**	**30**	**48**	**9**	**306**	**100.0%**

Table 5.2: Projectile Point Fragment Type by Lithic Material

	PROJECTILE POINT FRAGMENT TYPE*						
LITHIC MATERIAL SOURCE	**COMPLETE POINTS****	**POINT BASES*****	**POINT TIPS******	**BLADES *******	**EDGE**	**OTHER ********	**TOTALS**
WHITE RIVER GROUP SILICATES	36	19	10	10			75
HARTVILLE UPLIFT CHERT	26	22	6	6	1		61
SMOKY HILL JASPER	8	12	5	3			28
PERMIAN CHERT	1	4		2			7
UNIDENTIFIED CHERT	14	12	7	7		3	43
FOSSIL WOOD	6	8	2	1			17
QUARTZITE	1	2	1	1			5
KNIFE RIVER FLINT	3	2	1				6
ALIBATES AGATIZED DOLOMITE	2	2		1			5
PORCELLANITE		1					1
EDWARDS CHERT		1					1
TONGUE RIVER SILICIFIED SEDIMENT							0
TOTAL	97	85	32	31	1	3	249

***Includes both Folsom and Midland projectile points**

****The following specimens were designated as complete points: complete, and nearly complete**

*****The following specimens were designated as point bases: base, and base and blade**

******The following specimens were designated as tips: tip, and tip and blade**

*******The following specimens were designated as blades: blade, and blade and edge**

******** Other = No information was available on the fragment type.**

Table 5.3: Material Type by County (White River Group Silicates, Hartville, Smoky Hill Jasper, Permian, and All Other Materials)

	MATERIAL					
COUNTY	**WHITE RIVER GROUP SILICATES**	**HARTVILLE UPLIFT**	**SMOKY HILL JASPER**	**PERMIAN**	**ALL OTHER MATERIALS**	**TOTALS**
ARTHUR	1	1				**2**
BANNER			1		1	**2**
BLAINE		4				**4**
BOONE					1	**1**
BOX BUTTE		1				**1**
BROWN		1				**1**
CHASE	19	3	5		5	**32**
CHERRY		2			6	**8**
CUSTER		3			1	**4**
DAWES		1				**1**
DAWSON		1			1	**2**
DEUEL	1	5	1		1	**8**
DUNDY	6	1	1		1	**9**
FRANKLIN	1	1				**2**
GARDEN	5	4	1		5	**15**
GRANT					1	**1**
HALL					1	**1**
HARLAN	3	2	10	1	2	**18**
HITCHCOCK	1					**1**
HOOKER	3	7	2		3	**15**
JEFFERSON				5		**5**
KEITH	26	17	3		24	**70**
LANCASTER					1	**1**
LINCOLN	15	11	6	1	17	**50**
LOUP		1	1			**2**
MCPHERSON	8	2			6	**16**
MORRILL	2	1			1	**4**
NUCKOLLS			3	2	2	**7**
PAWNEE				1		**1**
RED WILLOW					2	**2**
SCOTTS BLUFF		1				**1**
SHERIDAN	4	1			2	**7**
SIOUX		2	1		2	**5**
THAYER			3			**3**
THOMAS	1	1			2	**4**
TOTALS	**96**	**74**	**38**	**10**	**88**	**306**
OTHER* = ALIBATES, EDWARDS PLATEAU, FOSSIL WOOD, KNIFE RIVER FLINT, PORCELLANITE, QUARTZITE, TONGUE RIVER SILICIFIED SEDIMENT, UNIDENTIFIED CHERT						

Table 5.4: All Lithic Materials by Ecoregion

Lithic Material Source	Region						
	Western High Plains	**South Platte River***	**Nebraska Sand Hills**	**North Platte River***	**Central Great Plains**	**Corn Belt Plains**	**Totals**
White River Group silicates	31	31	22	0	12	0	**96**
Hartville Uplift chert	13	19	24	3	15	0	**74**
Smoky Hill Jasper	9	5	4	0	20	0	**38**
Permian chert	0	0	0	0	9	1	**10**
Unidentified Chert	10	3	15	2	16	0	**46**
Fossil wood	1	13	4	0	4	0	**22**
Quartzite	3	0	2	0	0	0	**5**
Knife River flint	0	0	3	0	2	1	**6**
Alibates agatized dolomite	3	0	1	0	1	0	**5**
Porcelanite	1	0	0	0	0	0	**1**
Edwards chert	1	0	0	0	1	0	**2**
Tongue River silicified sediment	0	1	0	0	0	0	**1**
Total	**72**	**72**	**75**	**5**	**80**	**2**	**306**
*Note: The North Platte and South Platter River categories include all specimens found in these 2 respective streambeds							

Table 5.5: White River Group Silicates Artifacts by Reduction Stage and County

	WHITE RIVER GROUP SILICATES							
COUNTY	**REWORKED POINTS**	**NON-REWORKED POINTS**	**UNDETER-MINED POINTS**	**PREFORMS**	**CHANNELS**	**TOTAL # ARTIFACTS**	**DISTANCE TO PRIMARY SOURCE (KM)**	**% WITHIN THIS DISTANCE**
ARTHUR			1			**1**	168	1%
CHASE	3	4	4	4	4	**19**	159	20%
DEUEL	1					**1**	101	1%
DUNDY	4	1	1			**6**	175	6%
FRANKLIN			1			**1**	395	1%
GARDEN	1	1	3			**5**	125	5%
HARLAN	1	1	1			**3**	357	3%
HITCHCOCK		1				**1**	225	1%
HOOKER	1		1	1		**3**	227	3%
KEITH	4	9	7	5	1	**26**	159	27%
LINCOLN	3	4	2	5	1	**15**	233	16%
MCPHERSON	3	3	2			**8**	217	8%
MORRILL			2			**2**	97	2%
SHERIDAN	2	1	1			**4**	198	4%
THOMAS		1				**1**	270	1%
TOTALS	**23**	**26**	**26**	**15**	**6**	**96**	**NA**	**100%**
MEAN DISTANCE	**190**	**192**	**182**	**188**	**171**	**187**	**NA**	**NA**

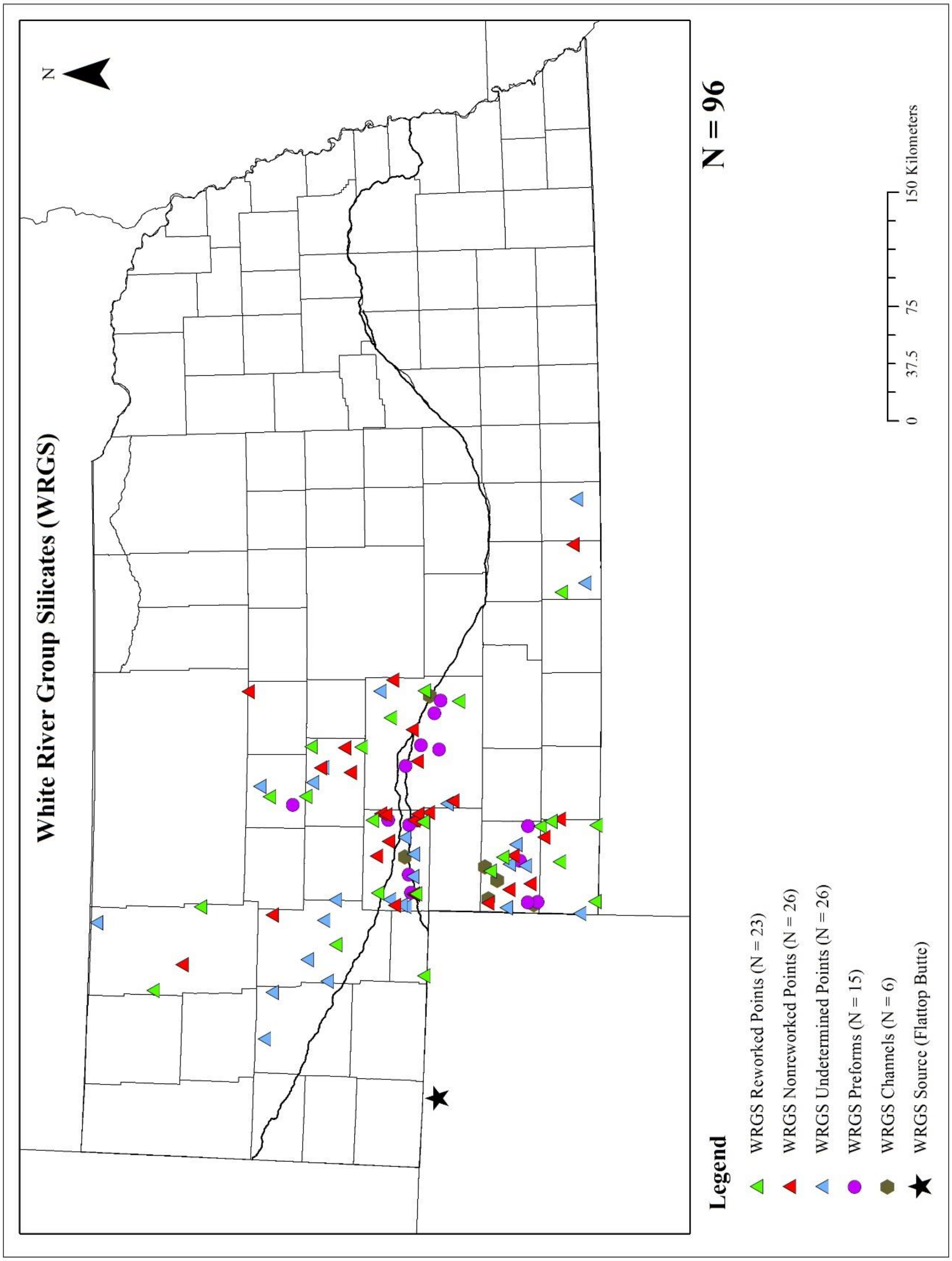

Figure 5.2: White River Group Silicates Distribution by Reduction Stage and County

Table 5.6: White River Group Silicates Artifacts by Reduction Stage and Ecoregion

	WHITE RIVER GROUP SILICATES					
ECOREGION	**REWORKED POINTS**	**NON-REWORKED POINTS**	**UNDETER-MINED POINTS**	**PREFORMS**	**CHANNELS**	**TOTAL # ARTIFACTS**
WESTERN HIGH PLAINS	7	6	10	4	4	**31**
SOUTH PLATTE RIVER	6	9	5	9	2	**31**
NEBRASKA SAND HILLS	7	6	8	1	0	**22**
NORTH PLATTE RIVER	0	0	0	0	0	**0**
CENTRAL GREAT PLAINS	3	5	3	1	0	**12**
CORN BELT PLAINS	0	0	0	0	0	**0**
TOTALS	**23**	**26**	**26**	**15**	**6**	**96**

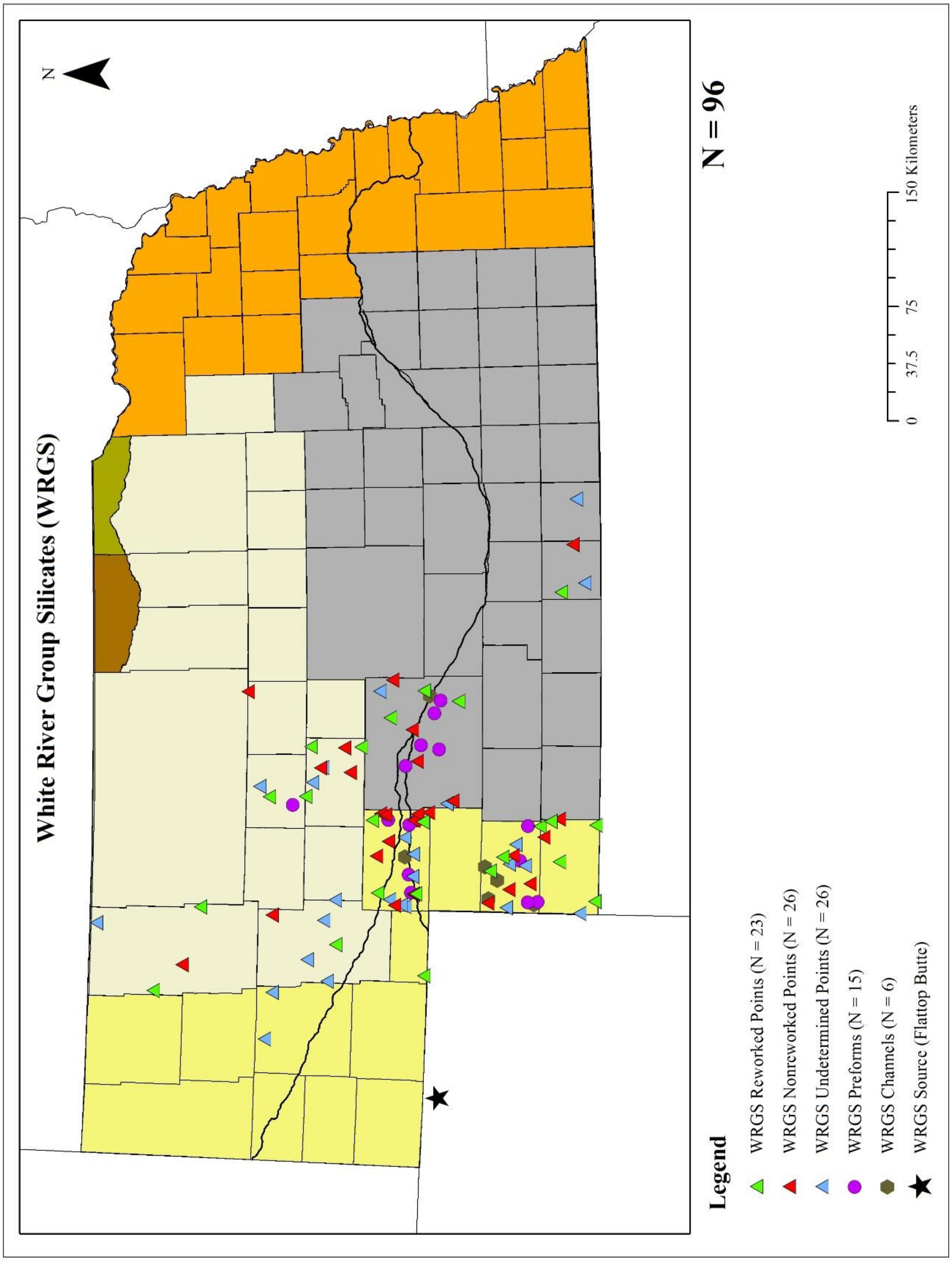

Figure 5.3: White River Group Silicates Distribution by Reduction Stage and Ecoregion

Hartville Uplift Chert: Overall Patterns

The Hartville Uplift chert source is in east-central Wyoming's Hartville Uplift, west of the Nebraska panhandle, and is also represented in secondary gravel deposits in the western Nebraska panhandle. The sample contains a total of 74 Hartville Uplift chert artifacts, or 24.2% of the total Nebraska Folsom sample (Figure 5.1). The maximum distance Hartville was moved from the source to the center of the county where the artifact was found was 540 km in Franklin County in south-central Nebraska, while the shortest distance was 82 km in far northwestern Sioux County (Table 5.7, Figure 5.4). The mean distance was 307 km (Table 5.7). Distances were calculated from the material source to the center of the county where the artifacts were found. The artifact types for the Hartville sample include 54 Folsom points, 7 Midland points, 11 preforms, and 2 channel flakes (Table 5.1). The total number of Folsom and Midland points is 61 and includes the following fragment types: 26 complete points, 22 point bases, 6 tips, 6 blades, and 1 edge (Table 5.2).

Table 5.3 and Figure 5.4 show the largest concentration of Hartville artifacts occurs in the North and South Platte River confluence in Keith (17 specimens) and Lincoln (11 specimens) Counties. All of the Hartville artifacts occur in the western half of Nebraska (Figure 5.4). The second largest frequency for Hartville artifacts is found in Hooker County with 7 specimens, followed by in Deuel with 4, 4 in Blaine, and 4 in Garden. Hartville artifacts are found in 18 other counties in western Nebraska and the number of specimens in these range from one to three. The eastern, southeastern, and northeastern parts of Nebraska are void of Hartville Folsom evidence.

Hartville Uplift artifacts are found in three ecoregions in western Nebraska and the South Platte River (Table 5.4, Figure 5.5). The distribution among the western ecoregions is fairly even with the Nebraska Sand Hills having 24 Hartville artifacts, Western High Plains has 13, and Central Great Plains has 15. Hartville artifacts are well represented in the South Platte River with 19 artifacts. No Hartville artifacts were found in the eastern and northeastern ecoregions of the Corn Belt Plains, Northwestern Great Plains, and the Northwestern Glaciated Plains (Figure 5.5).

Comparison of the Overall Distribution and Frequency of Hartville to White River Group Silicates. When we compare the overall distribution and frequency of Hartville Uplift chert to White River Groups Silicates (WRGS) we see that although the overall frequency of WRGS is greater than for Hartville artifacts, Hartville has a larger spatial distribution. The number of WRGS artifacts in the Central Plains Folsom dataset is 96 (Table 5.1). Hartville artifacts are well-represented in the dataset, but the frequency of this lithic material is less than WRGS with 74 artifacts. WRGS make up 31.4% of the sample whereas Hartville comprised 24.2% of the sample (Figure 5.1). Table 5.1 shows that the Central Plain Folsom dataset has slightly more WRGS than Hartville artifacts across every artifact type (i.e., points, preforms, and channel flakes).

Hartville artifacts are more widely distributed in Nebraska than are WRGS artifacts (Figures 5.2 and 5.4). While Hartville artifacts were found in 24 counties, WRGS artifacts were found in only 15 (Table 5.3). The counties located at the confluence of the North and South Platter Rivers (i.e., Keith and Lincoln) had the greatest concentration of both WRGS and Hartville artifacts (Table 5.3; Figures 5.2 and 5.4). Both WRGS and Hartville artifacts were concentrated in the western half of Nebraska with no evidence for either of these material types in either the southeastern or northeastern parts of the state. Hartville artifacts are better represented in the northwestern and central portions of Nebraska than are WRGS artifacts. WRGS and Hartville had similar frequencies in both the Nebraska Sand Hills and Central Great

Plains (Table 5.6 and 5.8; Figures 5.3 and 5.5). However, WRGS was found in greater frequency in both the Western High Plains and South Platte River streambed. No WRGS artifacts were found in the North Platte River streambed, while three Hartville artifacts were found there. Neither WRGS or Hartville artifacts were found in the eastern and northeastern ecoregions of the Corn Belt Plains, Northwestern Great Plains, and Northwestern Glaciated Plains (Figures 5.3 and 5.5).

Hartville Uplift Chert: Patterns in Reduction Stages

Hartville Preforms. The sample contains 11 Hartville preforms. The preforms occur in six counties (Table 5.7, Figure 5.4). The counties with the most Hartville preform evidence are in North and South Platte River confluence in Keith (with three Hartville preforms) and Lincoln (with four Hartville preforms) Counties. The counties with evidence for Hartville preforms have one specimen each. The remaining counties are: Cherry (in the northwest portion of Nebraska, bordering South Dakota), Hooker (located just below Cherry), Deuel (in the Nebraska panhandle), and Scotts Bluff (located in the far western portion of the state and bordering Wyoming). The distance from the source to each preform ranged between 100 and 361 km with a mean distance of 294 km (Table 5.7). Table 5.8 and Figure 5.5 show Hartville preforms occur in two ecoregions and the North and South Platte Rivers. The South Platte River had the most Hartville preform evidence with six specimens, while the North Platte River had two preforms. The Nebraska Sand Hills and the Central Great Plains had two and one Hartville preforms respectively.

Hartville Channel Flakes. Table 5.7 and Figure 5.4 show the sample contains two Hartville channel flakes, and these are from two counties—Chase (with one specimen and located in the Nebraska Panhandle) and Keith (with one specimen and located in the North and

South Platte River confluence). The distance from the Hartville source ranged from 285 to 323 km with a mean distance of 304 km (Table 5.7). Table 5.8 and Figure 5.5 show the Hartville channel flake evidence comes from only one ecoregion—the Western High Plains. The Hartville channel from Chase County is from the Nolan site, while the one from Keith County is from a private collection. The limited occurrence of channel flakes is again assumed to represent sampling bias which results from the fact that many avocational and professional archaeologists would not recognize this artifact type.

Hartville Non-Reworked Projectile Points. The Nebraska Folsom sample has a total of 20 Hartville non-reworked points from 11 counties from the northwest, west, and south-central part of the state (Table 5.7, Figure 5.4). The largest concentration of Hartville non-reworked points are from the confluence of the North and South Platte Rivers in Keith (six specimens) and Lincoln (four specimens) Counties (Table 5.7, Figure 5.4). The remaining counties in the sample have between one and two Hartville non-reworked points each. The distance from the source ranged from 82 to 540 km with a mean distance of 303 km (Table 5.7). Table 5.8 and Figure 5.5 show Hartville non-reworked points occur in three ecoregions and the North and South Platte River streambeds. The ecoregion with the largest evidence for Hartville non-reworked points is the Central Great Plains with six specimens. This is closely followed by the Nebraska Sand Hills with five specimens and Western High Plains with four. The South Platte River had 4 Hartville non-reworked points while the North Platte had one.

Hartville Reworked Projectile Points. The Nebraska Folsom sample has a total 21 Hartville reworked points. Table 5.7 and Figure 5.4 show that Hartville reworked points occur in 14 counties in the western half of Nebraska—each having between one and three specimens. The distance from the Hartville source to the county center where each Hartville reworked point was found ranges between 136 to 506 km, with an average mean distance of 311 km (Table 5.7). Table 5.8 and Figure 5.5 show that Hartville reworked points occur in three ecoregions in western and south-central Nebraska (the Nebraska Sand Hills with 9 specimens, the Central Great Plains with 5, and the Western High Plains with 4). The South Platte River had three Hartville reworked points.

Hartville Undetermined Projectile Points. The sample contains a total 20 Hartville points classified as undetermined in terms of reworking (Table 5.7, Table 5.8). The Hartville undetermined points occur in 10 counties from the west and southwest part of the state (Table 5.7, Figure 5.4). The county with the largest number of Hartville undetermined points was Keith County with 6 specimens. The remaining counties in the Hartville sample have between one and two specimens each. The distance from the source ranged from 214 to 441 km with a mean distance of 314 km (Table 5.7). Table 5.8 and Figure 5.5 show that Hartville non-reworked points occur in three ecoregions and the South Platte River. The ecoregion with the largest evidence for Hartville undetermined points is the Nebraska Sand Hills with eight specimens. This is closely followed by the South Platte River with 6 specimens, the Western High Plains with 3, and the Central Great Plains with 3.

Table 5.7: Hartville Artifacts by Reduction Stage and County

	HARTVILLE							
COUNTY	**REWORKED POINTS**	**NON-REWORKED POINTS**	**UNDETER-MINED POINTS**	**PREFORMS**	**CHANNELS**	**TOTAL # ARTIFACTS**	**DISTANCE TO PRIMARY SOURCE (KM)**	**% WITHIN THIS DISTANCE**
ARTHUR	1					**1**	265	1%
BLAINE	2		2			**4**	396	5%
BOX BUTTE	1					**1**	136	1%
BROWN		1				**1**	395	1%
CHASE	2				1	**3**	323	4%
CHERRY		1		1		**2**	298	3%
CUSTER	3					**3**	428	4%
DAWES		1				**1**	138	1%
DAWSON			1			**1**	441	1%
DEUEL	2		2	1		**5**	241	7%
DUNDY			1			**1**	350	1%
FRANKLIN		1				**1**	540	1%
GARDEN	1	1	2			**4**	214	5%
HARLAN	1	1				**2**	506	3%
HOOKER	3	1	2	1		**7**	301	9%
KEITH	1	6	6	3	1	**17**	285	23%
LINCOLN	1	4	2	4		**11**	361	15%
LOUP			1			**1**	439	1%
MCPHERSON	1		1			**2**	316	3%
MORRILL	1					**1**	158	1%
SCOTTS BLUFF				1		**1**	100	1%
SHERIDAN	1					**1**	192	1%
SIOUX		2				**2**	82	3%
THOMAS		1				**1**	348	1%
TOTALS	**21**	**20**	**20**	**11**	**2**	**74**	**NA**	**100%**
MEAN DISTANCE	**311**	**303**	**314**	**294**	**304**	**307**	**NA**	**NA**

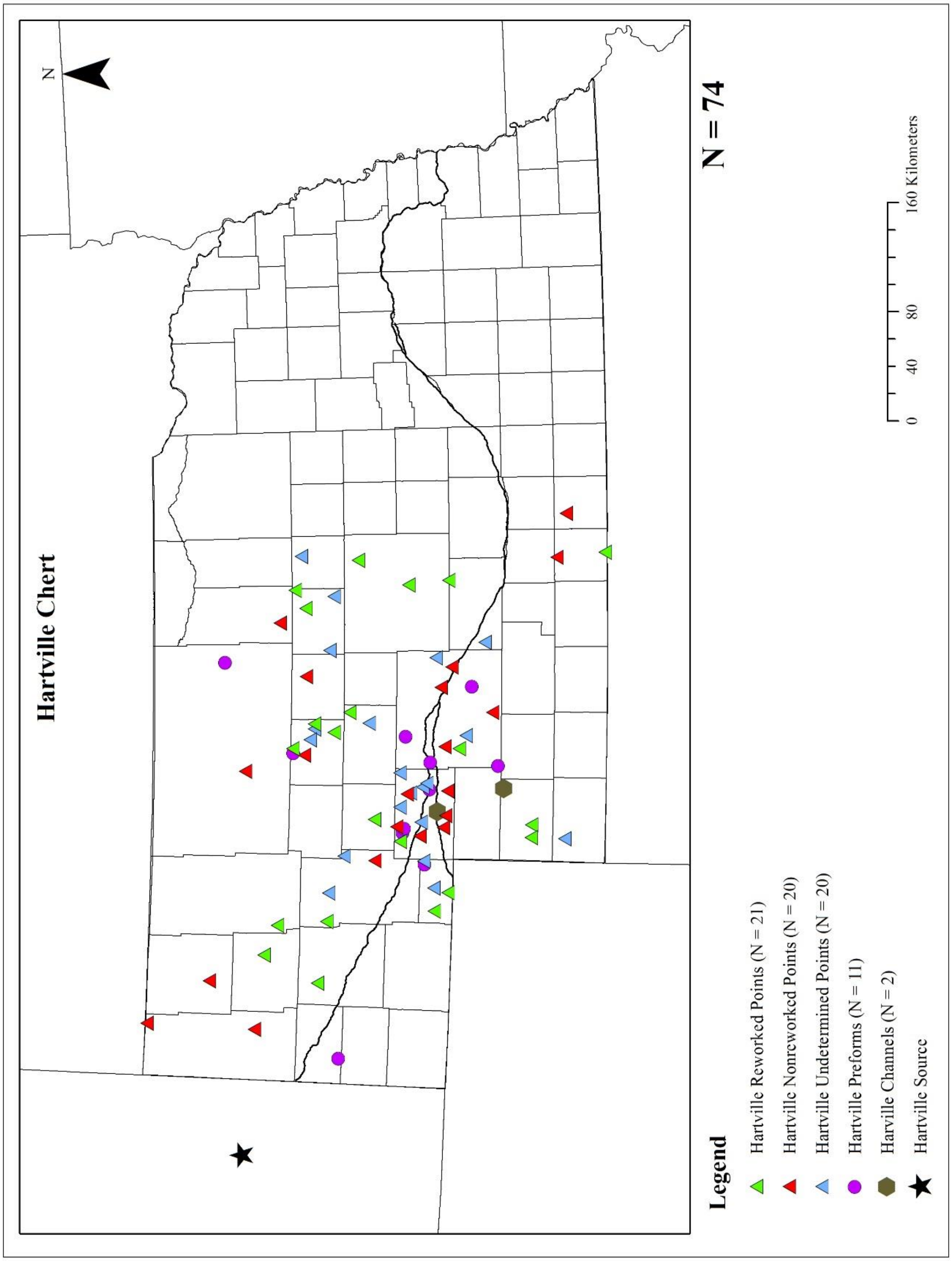

Figure 5.4: Hartville Chert Distribution by Reduction Stage and County

Table 5.8: Hartville Artifacts by Reduction Stage and Ecoregion

	HARTVILLE					
ECOREGION	**REWORKED POINTS**	**NON-REWORKED POINTS**	**UNDETER-MINED POINTS**	**PREFORMS**	**CHANNELS**	**TOTAL # ARTIFACTS**
WESTERN HIGH PLAINS	4	4	3	0	2	**13**
SOUTH PLATTE RIVER	3	4	6	6	0	**19**
NEBRASKA SAND HILLS	9	5	8	2	0	**24**
NORTH PLATTE RIVER	0	1	0	2	0	**3**
CENTRAL GREAT PLAINS	5	6	3	1	0	**15**
CORN BELT PLAINS	0	0	0	0	0	**0**
TOTALS	**21**	**20**	**20**	**11**	**2**	**74**

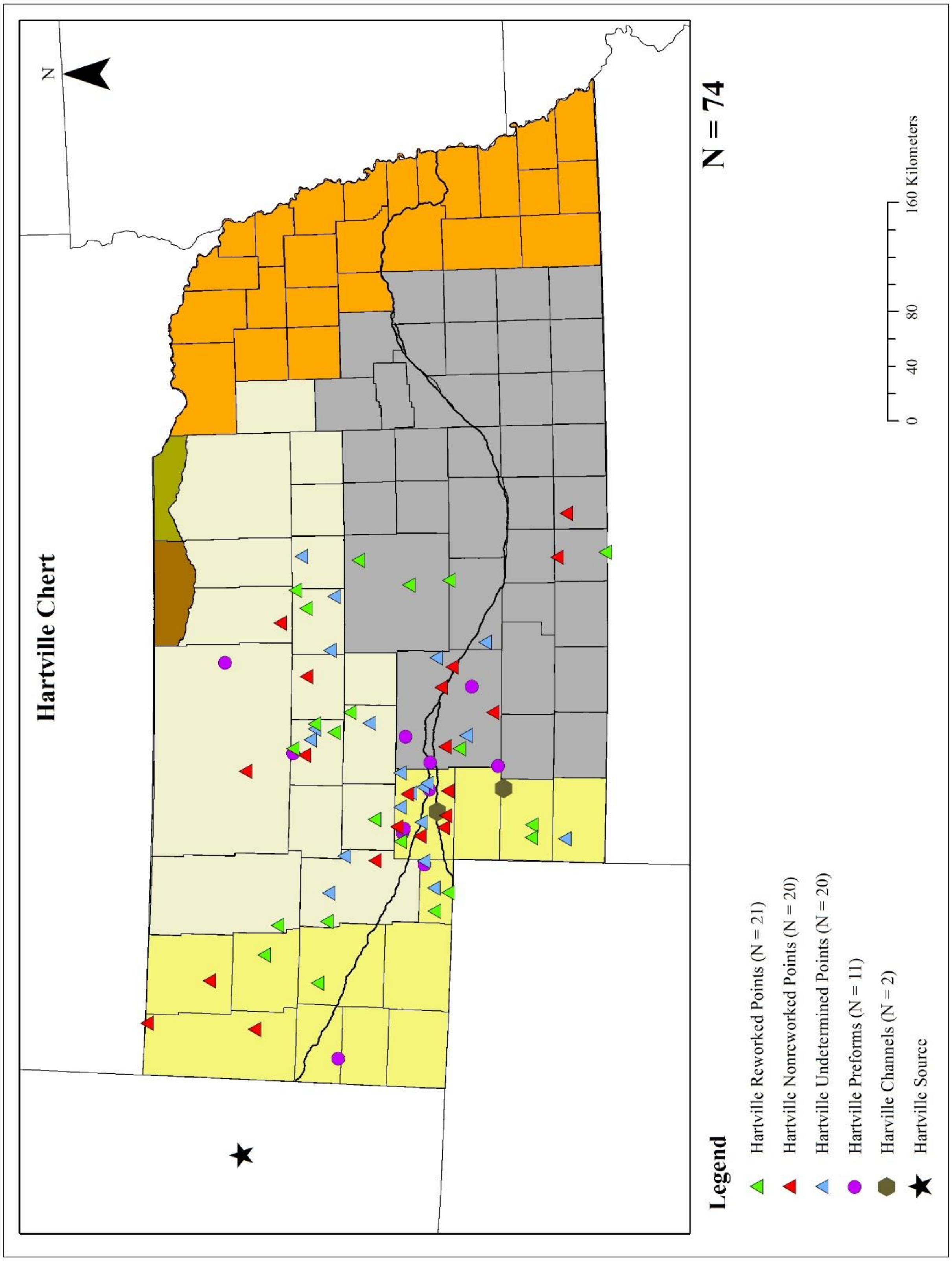

Figure 5.5: Hartville Chert by Reduction Stage and Ecoregion

Smoky Hill Jasper (SHJ): Overall Patterns

The primary sources of Smoky Hill Jasper (SHJ) are in the Republican River drainage in south-central Nebraska and northern Kansas. The Nebraska Folsom sample contains a total 38 artifacts made of SHJ, comprising 12.4% of the total sample (Figure 5.1). Medicine Creek Reservoir in Frontier County, Nebraska is the closest source for SHJ so this source was used to determine distances. SHJ was moved into Nebraska from the west, northwest, north and southeast direction from the source. This movement to the north and west could not have been by alluvial transport. The maximum distance from the source area was 375 km in Sioux County in the far northwest corner of Nebraska, while the minimum distance was 75 km to Harlan County located in south-central Nebraska along the Kansas state border (Table 5.9, Figure 5.6). The mean distance from the source to the center of the county was 141 km (Table 5.9).

The artifact types for the SHJ sample include 24 Folsom points, 4 Midland points, and 10 preforms. No evidence for SHJ channel flakes was documented (Table 5.1). The total number of SHJ projectile points (Folsom and Midland) is 28 and breaks down into the following point fragment types: 8 complete points, 12 point bases, 5 tips, and 3 blades (Table 5.2).

Table 5.3 and Figure 5.6 show that Harlan County has the most SHJ artifacts with 10 specimens. Other counties with evidence are Lincoln with 6 specimens, Chase with 5, Keith with 3, Nuckolls with 3, and Thayer with 3. Lincoln and Keith Counties are in the confluence of the North and South Platte Rivers. Chase County is located in southwestern Nebraska. Harlan County is located in the southern tier of Nebraska counties bordering Kansas and lies near Franklin County, where the Medicine Creek Reservoir SHJ source area is located. Nuckolls and Thayer Counties are also located in the southern tier of Nebraska counties but further to the east. Seven other Nebraska counties have SHJ Folsom artifacts and contain between one and two specimens each. Most of these are located in western Nebraska. One is located in the far northwest corner of Nebraska in Sioux County and one in the north-centrally located Loup County.

SHJ Folsom artifacts are found in 3 ecoregions and the South Platte River (Table 5.4 and Figure 5.7). The Central Great Plains of Nebraska has the most evidence for SHJ artifacts with 20 specimens. The next highest frequency comes from the Western High Plains with nine SHJ artifacts. The Nebraska Sand Hills and the South Platte River have four and five SHJ artifacts respectively. The eastern and northeastern Nebraska ecoregions (the Corn Belt Plains, Northwestern Glaciated Plains, and Northwest Great Plains) are void of SHJ evidence, as is the North Platte River.

Comparison of the Overall Distribution and Frequency of Smoky Hill Jasper to White River Group Silicates and Hartville. When we compare the overall frequency of Smoky Hill Jasper to White River Group Silicates (WRGS) and Hartville we see that the overall frequencies of WRGS and Hartville are greater than for Smoky Hill Jasper. Smoky Hill Jasper makes up an important minority of the Central Plains Folsom database with 38 specimens, while WRGS has 96 and Hartville has 74 (Figure 5.1, Table 5.1). Table 5.1 shows that Smoky Hill Jasper comprises 12.4% of the total sample, while WRGS comprises 31.4% and Hartville comprises 24.2%. Table 5.1 shows that Smoky Hill Jasper has fewer artifacts than WRGS and Hartville across every artifact category (Folsom points, Midland points, preforms, and channel flakes).

A comparison of the spatial distributions shows that Smoky Hill Jasper artifacts in the Central Plains Folsom dataset are found in 13 counties as opposed to 15 counties for WRGS and 24 counties for Hartville (Table 5.3). The counties with the greatest concentration of both WRGS and Hartville artifacts were Keith and Lincoln—both located at the confluence of the North and South Platte Rivers (Table 5.3; Figures 5.2 and 5.4). However, Smoky Hill Jasper showed a different pattern. Smoky Hill Jasper artifacts were found in Keith and Lincoln counties, but the greatest frequency and concentration for Smoky Hill Jasper artifacts was in Harlan County located in south-central Nebraska along the southern tier of counties bordering Kansas (Table 5.3; Figure 5.6). While WRGS and Hartville artifacts were concentrated in the western half of Nebraska, Smoky Hill Jasper also showed this pattern, but with an important number of artifacts in the southern tier of counties along the Nebraska-Kansas border (i.e., Harlan, Nuckolls, and Thayer Counties) (Figure 5.6). Hartville is better represented in the central and northwestern parts of Nebraska than Smoky Hill Jasper and WRGS (Figures 5.2, 5.4, and 5.6).

Smoky Hill Jasper artifacts are better represented in the Central Great Plains ecoregion than are WRGS and Hartville artifacts (Tables 5.6, 5.8, and 5.10; Figures 5.3, 5.5, and 5.7). Smoky Hill Jasper has fewer artifacts in the Western High Plains, South Platte River, and Nebraska Sand Hills than Hartville and WRGS. The North Platte River has no Smoky Hill Jasper or WRGS artifacts. No Smoky Hill Jasper, WRGS, or Hartville artifacts were found in the eastern and northeastern ecoregions of the Corn Belt Plains, Northwestern Great Plains, and the Northwestern Glaciated Plains.

Smoky Hill Jasper (SHJ): Patterns in Reduction Stages

Smoky Hill Jasper Preforms. Table 5.9 and Figure 5.6 show the sample contains 10 SHJ preforms from six counties. The largest evidence comes from Harlan County with three SHJ preforms. The remaining counties (Chase, Lincoln, Loup, Nuckolls, and Thayer) have between one and two SHJ preforms. The distance from the primary SHJ source ranged from 75 to 226 km with a mean distance of 134 km (Table 5.9). The evidence for SHJ preforms comes from three ecoregions and the South Platte River streambed (Table 5.10 and Figure 5.7). The Central Great

Plains had the most evidence with six, while the Western High Plains and Nebraska Sand Hills contained one SHJ preform each. The South Platte River had two SHJ preforms.

Smoky Hill Jasper Channel Flakes. The sample contained no SHJ channel flakes (Tables 5.9 and 5.10). This lack of SHJ channel evidence is presumably a reflection of the limited sample.

Smoky Hill Jasper Non-Reworked Projectile Points. The Nebraska Folsom sample has a total of seven SHJ non-reworked points and these are found in five counties (Chase, Dundy, Lincoln, Harlan and Thayer) all containing between one and two specimens each (Table 5.9 and Figure 5.6). The distance from the source ranged between 75 and 226 km, with a mean distance of 119 km (Table 5.9). Table 5.10 and Figure 5.7 show SHJ non-reworked points were found in two ecoregions—the Western High Plains with three and the Central Great Plains with four.

Smoky Hill Jasper Reworked Projectile Points. Table 5.9 and Figure 5.6 show the Nebraska Folsom sample has only 3 SHJ reworked points and these are found in three counties (Harlan, Nuckolls, and Keith) each containing one specimen each. The maximum distance from the source for SHJ reworked points was 188 km, while the shortest distance was 75 km and the mean distance was 137 km (Table 5.9). SHJ reworked points were found in one ecoregion (the Central Great Plains with two specimens) and the South Platte River had one specimen (Table 5.10 and Figure 5.7).

Smoky Hill Jasper Undetermined Projectile Points. The sample contains 18 SHJ points that were classified as undetermined in terms of reworking (Table 5.9, Figure 5.6). The evidence for undetermined points is scattered across 10 counties. The greatest evidence for SHJ undetermined points was found in Harlan (four specimens) and Lincoln (three specimens) Counties. The remaining counties had one to two specimens each (Banner, Chase, Deuel, Garden, Hooker, Keith, Nuckolls, and Sioux). The distance to the primary SHJ source ranged between 75 and 375 km with a mean distance of 154 km (Table 5.9). Undetermined SHJ points are found in three ecoregions and the South Platte River (Table 5.10, Figure 5.7). The Central Great Plains had the most evidence with eight SHJ undetermined points. The Western High Plains had five and the Nebraska Sand Hills had three. The South Platte River had two specimens. The eastern and northeastern Nebraska ecoregions (the Corn Belt Plains, Northwestern Glaciated Plains, and Northwest Great Plains) as well as the North Platte River had no SHJ undetermined points.

Table 5.9: Smoky Hill Jasper Artifacts by Reduction Stage and County

	SMOKY HILL JASPER							
COUNTY	**REWORKED POINTS**	**NON-REWORKED POINTS**	**UNDETER-MINED POINTS**	**PREFORMS**	**CHANNELS**	**TOTAL # ARTIFACTS**	**DISTANCE TO PRIMARY SOURCE (KM)**	**% WITHIN THIS DISTANCE**
BANNER			1			**1**	319	3%
CHASE		2	2	1		**5**	125	13%
DEUEL			1			**1**	194	3%
DUNDY		1				**1**	126	3%
GARDEN			1			**1**	222	3%
HARLAN	1	2	4	3		**10**	75	26%
HOOKER			2			**2**	184	5%
KEITH	1		2			**3**	149	8%
LINCOLN		1	3	2		**6**	83	16%
LOUP				1		**1**	180	3%
NUCKOLLS	1		1	1		**3**	188	8%
SIOUX			1			**1**	375	3%
THAYER		1		2		**3**	226	8%
TOTALS	**3**	**7**	**18**	**10**	**0**	**38**	**NA**	**100%**
MEAN DISTANCE	**137**	**119**	**154**	**134**	**0**	**141**	**NA**	**NA**

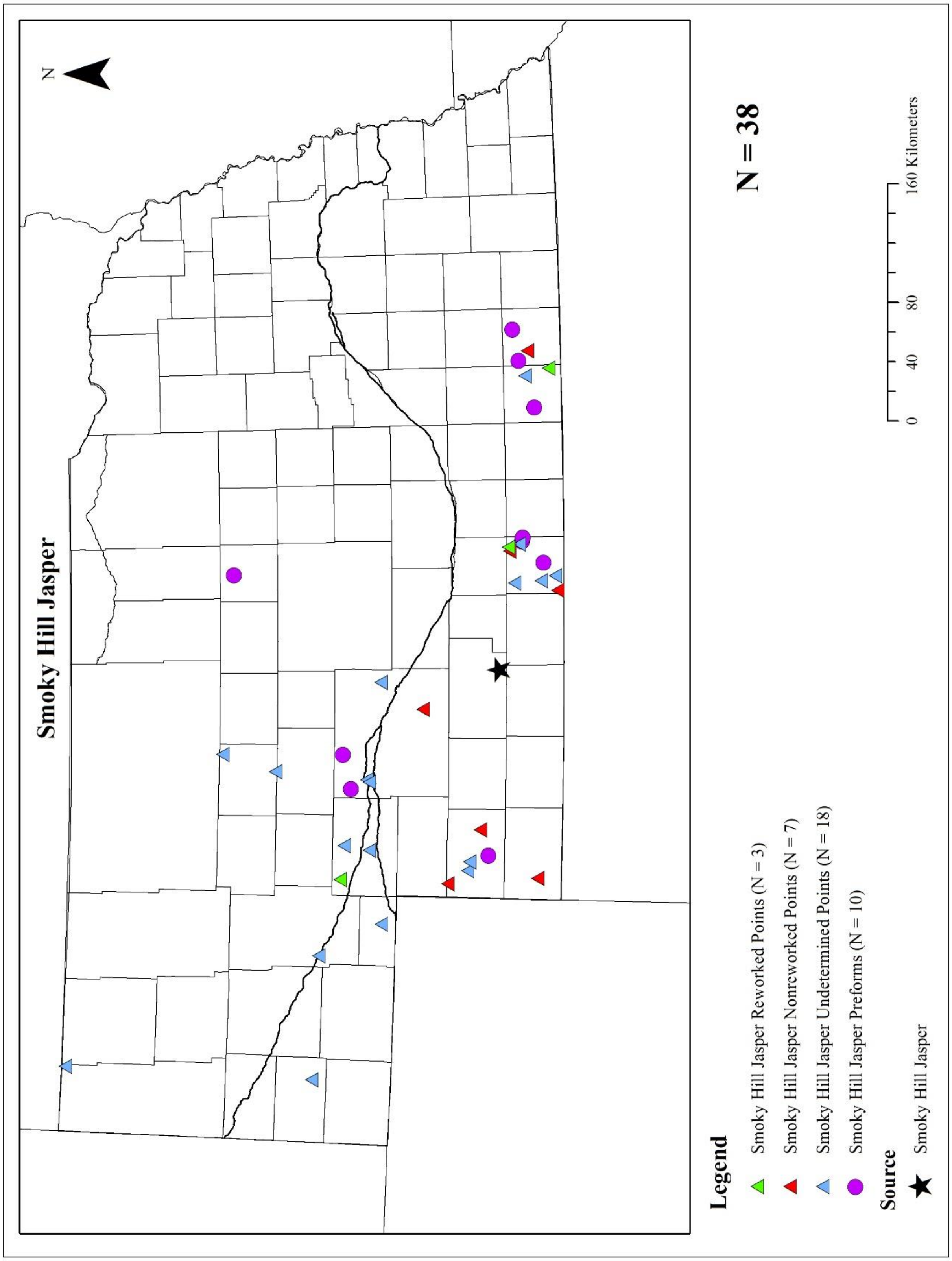

Figure 5.6: Smoky Hill Jasper Distribution by Reduction Stage and County

Table 5.10: Smoky Hill Jasper Artifacts by Reduction Stage and Ecoregion

	SMOKY HILL JASPER					
ECOREGION	**REWORKED POINTS**	**NON-REWORKED POINTS**	**UNDETER-MINED POINTS**	**PREFORMS**	**CHANNELS**	**TOTAL # ARTIFACTS**
WESTERN HIGH PLAINS	0	3	5	1	0	**9**
SOUTH PLATTE RIVER	1	0	2	2	0	**5**
NEBRASKA SAND HILLS	0	0	3	1	0	**4**
NORTH PLATTE RIVER	0	0	0	0	0	**0**
CENTRAL GREAT PLAINS	2	4	8	6	0	**20**
CORN BELT PLAINS	0	0	0	0	0	**0**
TOTALS	**3**	**7**	**18**	**10**	**0**	**38**

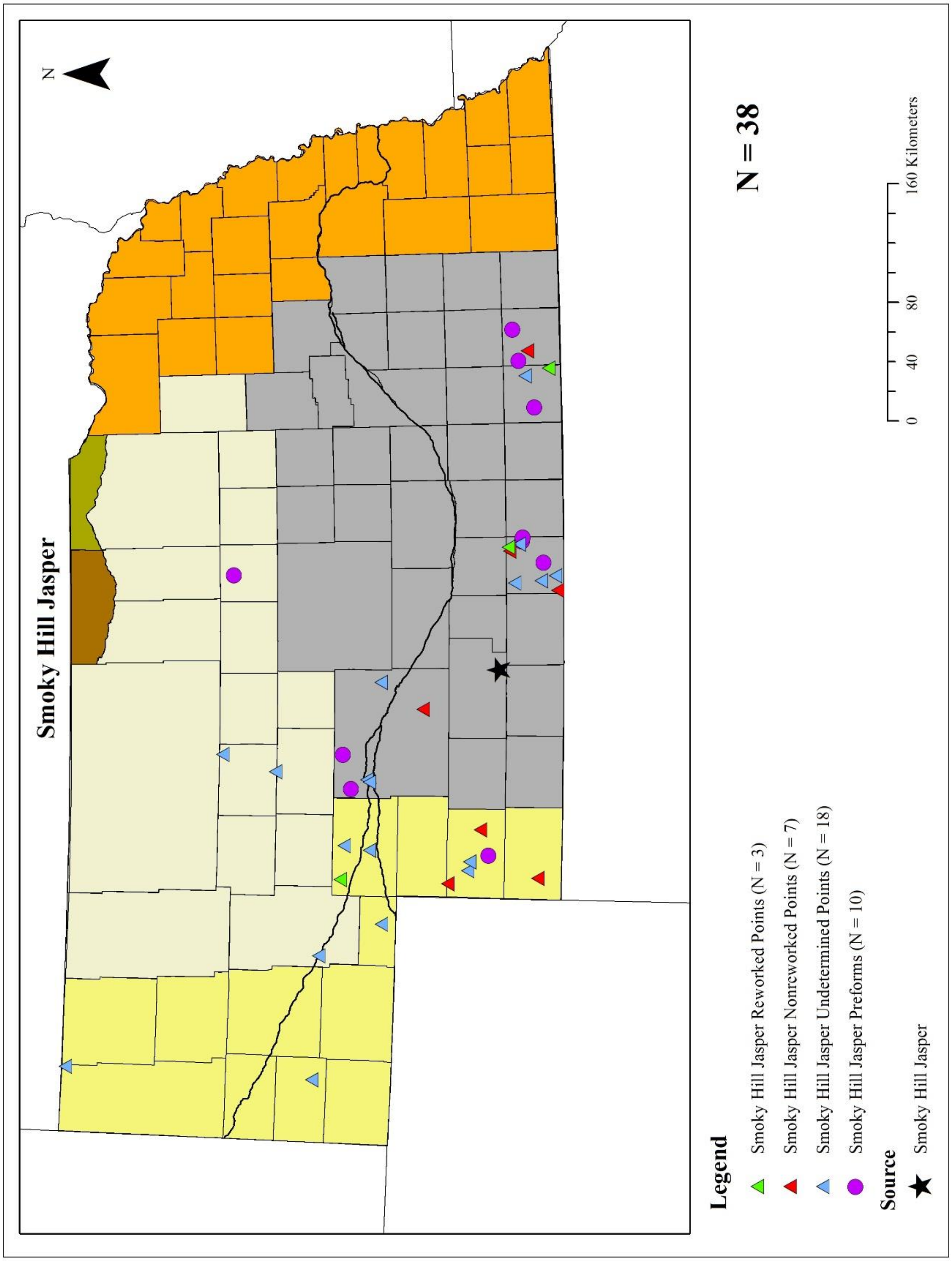

Figure 5.7: Smoky Hill Jasper Distribution by Reduction Stage and Ecoregion

Patterns in White River Group Silicates (WRGS), Hartville, and Smoky Hill Jasper (SHJ) Preforms

Figures 5.8 and 5.9 show the distributions for preforms of the three main lithic materials and their respective source areas—White River Group Silicates (WRGS), Hartville, and Smoky Hill Jasper (SHJ). The figures show a small overlap between the Hartville and WRGS preform spatial distributions. A small overlap between SHJ and WRGS preform distributions also exists. The only overlap between Harville and SHJ preforms is in Keith County.

The importance of the preform distributions is that preforms capture an intermediate stage of production that finished points do not. Preforms being found away from the source indicate that not all production happens at the source (Figures 5.8 and 5.9). They are a clear indication that points are produced as needed during movement across the landscape. Preforms being found at a distance from the source is an indication that bifaces or flake blank preforms are being transported for potential use and reflect the scale of transporting that lithic material as staged material, not as finished implements.

The Nebraska Folsom sample has 15 WRGS preforms found at a distance of 159 to 233 km from the source with a mean distance of 188 km (Table 5.5). The majority of the WRGS preform evidence, nine preforms, were found 159 km from the source (those from Chase and Keith Counties). Five WRGS preforms were found in Lincoln County at a distance of 233 km and one was found at similar distance of 227 km in Hooker County. The sample had 11 Hartville preforms found between 100 and 361 km from the source with a mean of 294 km (Table 5.7). The majority of the Hartville preforms, seven preforms, were found in Lincoln and Keith Counties at a distance of 361 and 285 km respectively. Two Hartville preforms were found in Cherry and Deuel Counties at a distance of 298 and 241 km respectively. One Hartville preform was found 100 km from the source in Scotts Bluff County. The Nebraska Folsom sample had 10

SHJ preforms which ranged between 75 and 226 km from the source with a mean distance of 134 km (Table 5.9). Half of the SHJ preform evidence, was found in Harlan and Lincoln Counties at a distance of 75 and 83 km respectively. A secondary distance where SHJ preforms were found was in Chase, Loup, and Nuckolls Counties ranging between 125 to 188 km. A third group was from Thayer County with two SHJ preforms at a distance of 226 km from the source. Figure 5.8 shows the preform distribution with source areas for White River Group Silicates (WRGS), Hartville, and Smoky Hill Jasper. The blue star in the figure represents the WRGS source area (the Flattop Butte source) while the smaller blue arc (circle) represents the mean distance for WRGS preforms. The larger blue arc/circle represents the limit from the source where WRGS preforms were found. The red star in the same figure represents the Hartville Uplift chert source while the smaller red arc/circle represents the mean distance and the larger red arc/circle represents the limit where Hartville preforms were found. The green star represents a primary source of Smoky Hill Jasper (the Medicine Creek Reservoir source). The smaller green circle represents the mean distance where Smoky Hill Jasper preforms were found while the larger green circle represents the limit where Smoky Hill Jasper preforms were found for this study.

There appear to be arcs of distance in the WRGS, Hartville, and SHJ preform distributions (Figure 5.8). The distributions show some preforms were found closer to the source so production was happening in that viscinity. Then, as people traveled and had kill events in between the last point of production there may be a distance at which you need to replenish your projectile points—hence that distance becomes another place of production. Therefore, some production is happening closer to the source, and then some production happens at a farther distance from the source. If a Folsom group were using all of the sources (WRGS, Hartville, and

Smoky Hill Jasper) in an annual or seasonal cycle, then you might see a lot of preforming at the Smoky Hill source, if they're arriving there with a depleted assemblage from the White River Group Silicates source. This dataset may not allow this to be assessed, but it is among the types of questions that could be assessed with these kinds of datasets.

The average distances for WRGS, Hartville, and Smoky Hill Jasper preforms from the source varies. The average distance Smoky Hill Jasper preforms were found from the source was 134 km (Table 5.9), while the average for WRGS preforms was 188 km (Table 5.5), and 294 km for Hartville preforms (Table 5.7). Smoky Hill Jasper preforms had the shortest average distance for preforms from the source while Hartville had the largest. It is important to note that Table 5.5 shows the average distances for WRGS non-reworked points (192 km) and reworked points (190 km) was essentially the same as for WRGS preforms (188 km). The pattern seen in the Hartville preforms, non-reworked, and reworked points was similar. Table 5.7 shows that Hartville non-reworked points were found 303 km from the source while reworked points were found 311 km from the source. Hartville preforms were found at a similar distance of 294 km from the source. Smoky Hill Jasper reworked points were found at an average distance of 137 km from the source while Smoky Hill Jasper preforms were found at an average distance of 134 km—therefore essentially the same average distance for these (Table 5.9). Smoky Hill Jasper non-reworked points were found at an average distance of 119 km from the source, so a little bit shorter distance for Smoky Hill Jasper non-reworked points than for the reworked points and preforms. For all three materials, WRGS, Hartville, and Smoky Hill Jasper, the preforms were found at essentially the same distances as the non-reworked and reworked points. As previously stated, preforms are evidence of production and the fact that they are found at a distance from the source is a clear indication that not all production happens at the source.

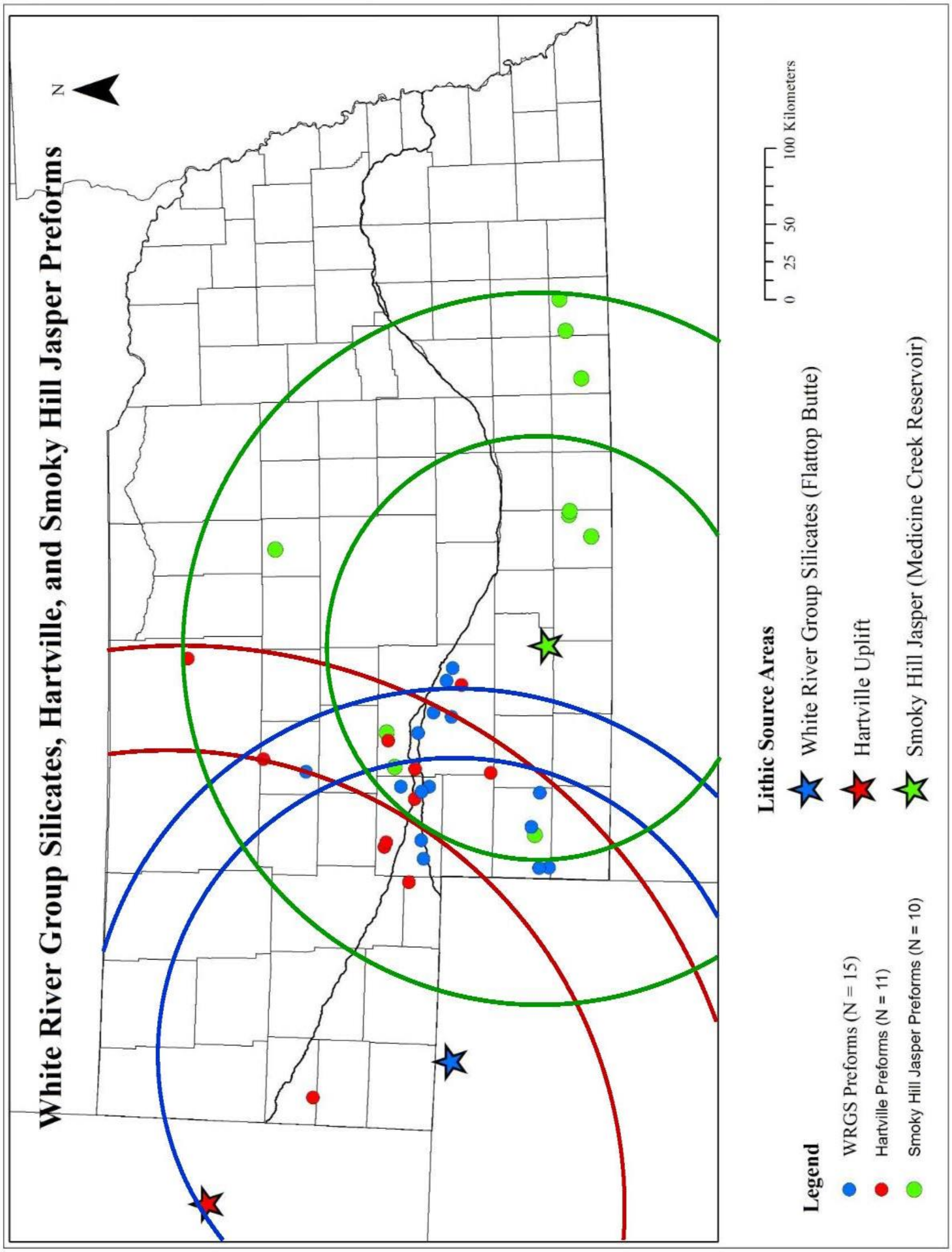

Figure 5.8: White River Group Silicates, Hartville, and Smoky Hill Jasper Preforms by County

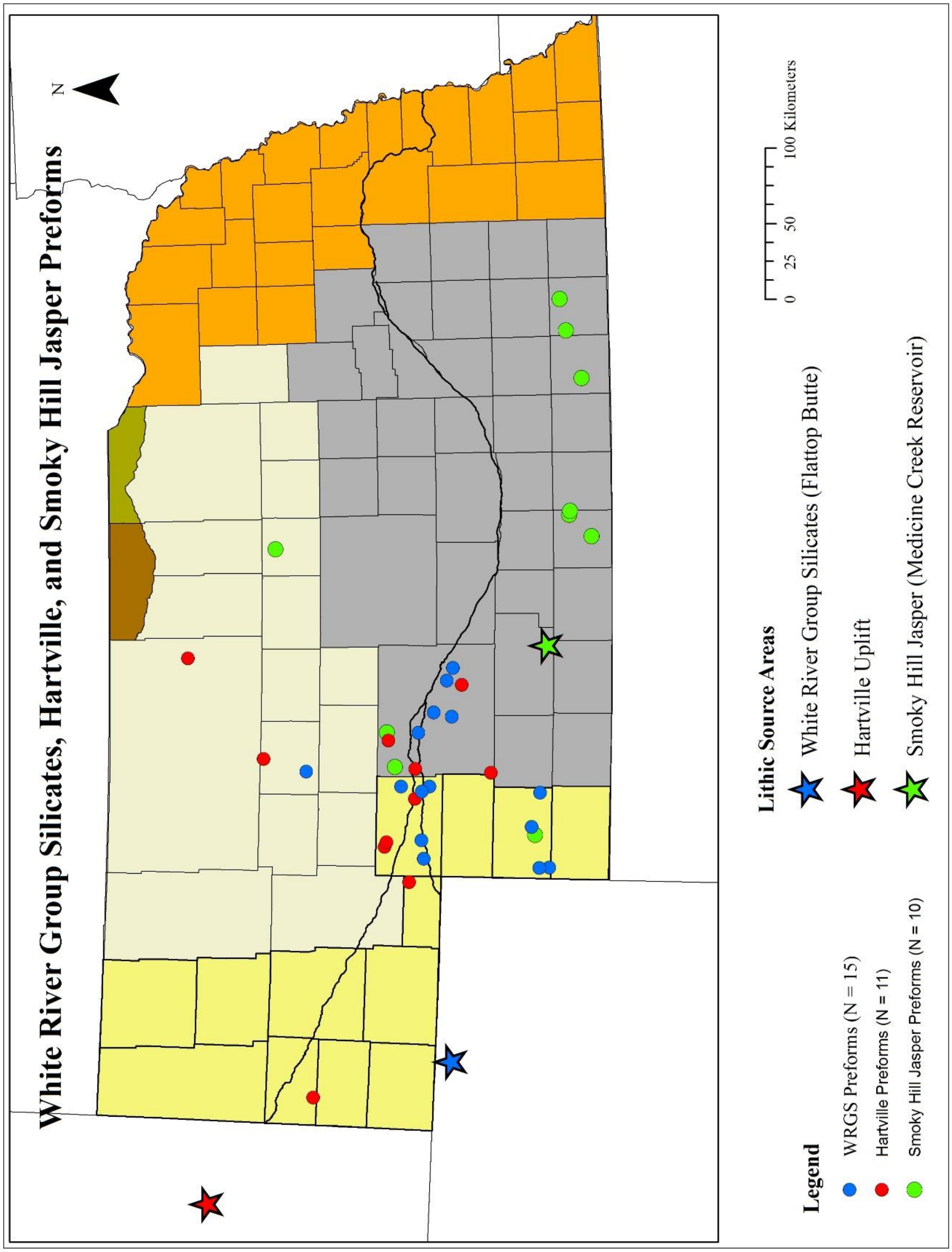

Figure 5.9: White River Group Silicates, Hartville, and Smoky Hill Jasper Preforms by Ecoregion

Permian Chert Patterns

Permian cherts have outcrops in southeastern Nebraska and the Flint Hills of Kansas. Figure 5.10 shows the primary Permian source (used to conservatively determine distances from source for this study) was the Florence “B” source at the north end of the Flint Hills, just east of Beatrice, Nebraska in Gage County. Permian chert was moved in a western, northwestern, and eastern direction from this source (and from other potential source areas further south). The Nebraska Folsom sample contains 10 Permian chert artifacts making up 3.3% of the total sample (Figure 5.1). The maximum distance from the source was 363 km to Lincoln County while the minimum was 32 km to Pawnee County (Table 5.11).

The artifact types for the Permian sample include 7 Folsom points and three preforms (Table 5.1). No Permian chert Midland points or channel flakes were documented. The Permian Folsom points are represented in the following fragment types: 1 complete point, 4 bases, and 2 blades (Table 5.2).

Tables 5.3 and 5.11, and Figure 5.10 show that Permian artifacts occurred in five Nebraska counties. The county with the most Permian chert artifacts was Jefferson which is near primary Permian sources in Gage County in southeastern Nebraska. Jefferson County contains half of the Permian sample with 5 artifacts (Figure 10). Two other counties in southeastern Nebraska had Permian artifacts—Pawnee and Nuckolls. The other two counties with Permian specimens are Harlan County in south-central Nebraska and Lincoln County which includes the confluence of the North and South Platte River. It is interesting to note that Permian chert seems to follow a different pattern from other material types in this study in that little evidence for Permian chert Folsom artifacts was found in the North and South Platte Confluence.

Permian artifacts are documented in two ecoregions (Table 5.12 and Figure 5.11). The south-centrally located Central Great Plains had the most Permian chert evidence with nine artifacts. The eastern Nebraska ecoregion, the Corn Belt Plains, had one Permian artifact.

Permian Chert: Patterns in Reduction Stages

Permian Chert Preforms. The sample has three Permian chert preforms (Table 5.11 and 5.12). Two of these were found in Jefferson County located 48 km from the source (Table 5.11 and Figure 5.10). One was found in Nuckolls County some 124 km from the source. Both Jefferson and Nuckolls Counties are located in southeastern Nebraska and neighbor Gage County where a primary Permian chert source is located. Table 5.12 and Figure 5.11 show that all three Permian chert preforms are from the Central Great Plains ecoregion in south-central Nebraska. *Permian Chert Channel Flakes*. No evidence for Permian chert channel flakes was documented in this study (Tables 5.11 and 5.12).

Permian Chert Non-Reworked Projectile Points. The Nebraska Folsom sample has a total of three non-reworked points (Tables 5.11 and 5.12). Table 5.11 and Figure 5.10 show the Permian chert non-reworked points occur in Lincoln County at the North and South Platte River confluence, Harlan County in south-central Nebraska, and Pawnee County in southeast Nebraska. The Permian non-reworked points lie between 32 and 363 km from the source (Table 5.11). Permian non-reworked points are found in two Nebraska ecoregions. The south-centrally located Central Great Plains has two while the Corn Belt Plains located in the eastern quarter of Nebraska has 1 (Table 5.12, Figure 5.11).

Permian Chert Reworked Projectile Points. The Nebraska Folsom sample does not include documented evidence of Permian reworked points (Tables 5.11 and 5.12).

Permian Chert Undetermined Projectile Points. The sample contains four Permian chert points with undetermined reworking (Tables 5.11 and 5.12). Three Permian undetermined points were found in Jefferson County while Nuckolls County had one (Table 5.11, Figure 5.10). Both of these counties are in the southern tier of Nebraska counties near the Nebraska-Kansas border and lie between 48 and 124 km from Permian chert sources near Beatrice, Nebraska (Table 5.11). All four Permian undetermined points are from one ecoregion—the south-centrally located Central Great Plains (Table 5.12 and Figure 5.11).

Table 5.11: Permian Chert Artifacts by Reduction Stage and County

	PERMIAN							
COUNTY	**REWORKED POINTS**	**NON-REWORKED POINTS**	**UNDETER-MINED POINTS**	**PREFORMS**	**CHANNELS**	**TOTAL # ARTIFACTS**	**DISTANCE TO PRIMARY SOURCE (KM)**	**% WITHIN THIS DISTANCE**
HARLAN		1				**1**	240	10%
JEFFERSON			3	2		**5**	48	50%
LINCOLN		1				**1**	363	10%
NUCKOLLS			1	1		**2**	124	20%
PAWNEE		1				**1**	32	10%
TOTALS	**0**	**3**	**4**	**3**	**0**	**10**	**NA**	**100%**

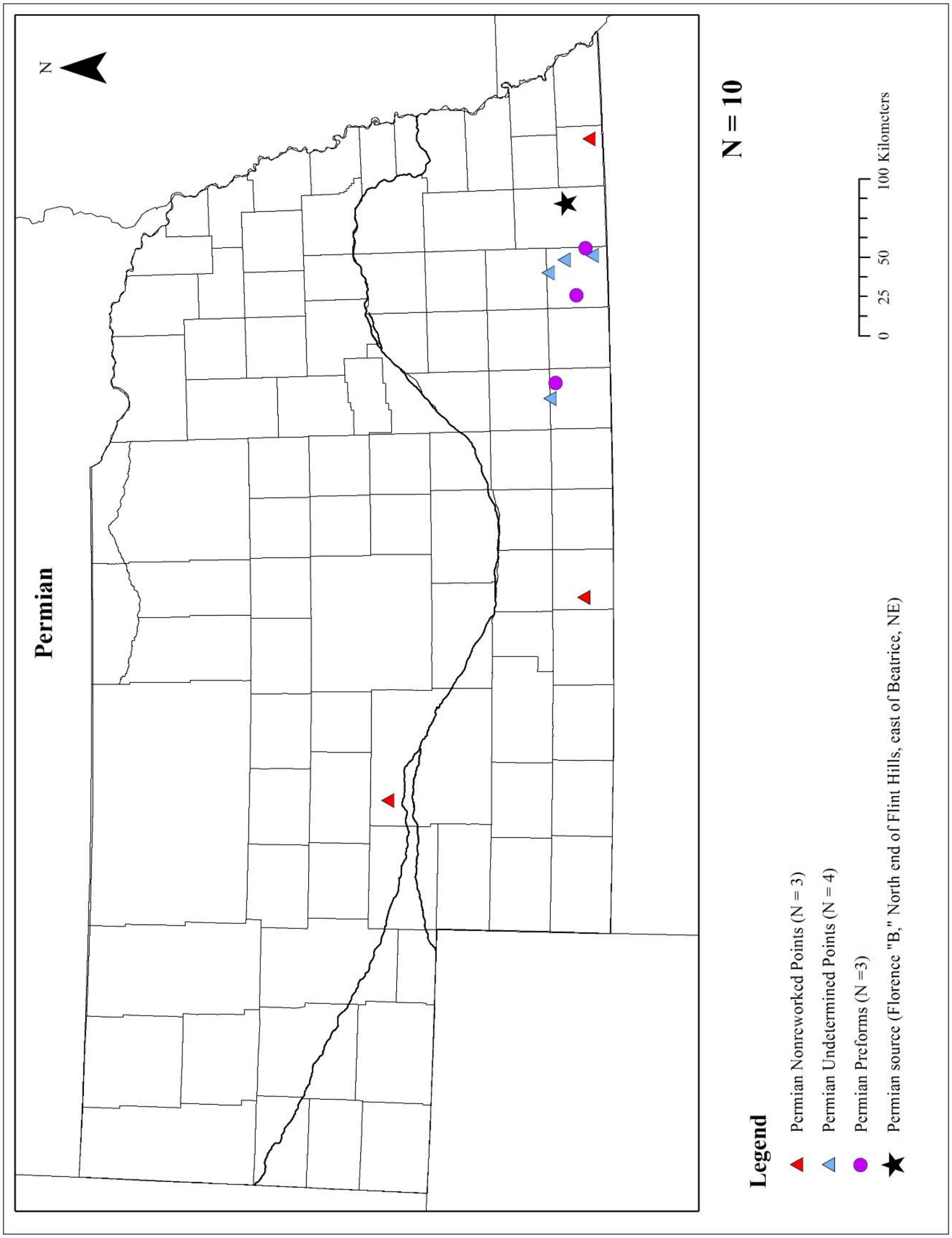

Figure 5.10: Permian Chert Distribution by Reduction Stage and County

Table 5.12: Permian Chert Artifacts by Reduction Stage and Ecoregion

	PERMIAN					
ECOREGION	**REWORKED POINTS**	**NON-REWORKED POINTS**	**UNDETER-MINED POINTS**	**PREFORMS**	**CHANNELS**	**TOTAL # ARTIFACTS**
WESTERN HIGH PLAINS	0	0	0	0	0	**0**
SOUTH PLATTE RIVER	0	0	0	0	0	**0**
NEBRASKA SAND HILLS	0	0	0	0	0	**0**
NORTH PLATTE RIVER	0	0	0	0	0	**0**
CENTRAL GREAT PLAINS	0	2	4	3	0	**9**
CORN BELT PLAINS	0	1	0	0	0	**1**
TOTALS	**0**	**3**	**4**	**3**	**0**	**10**

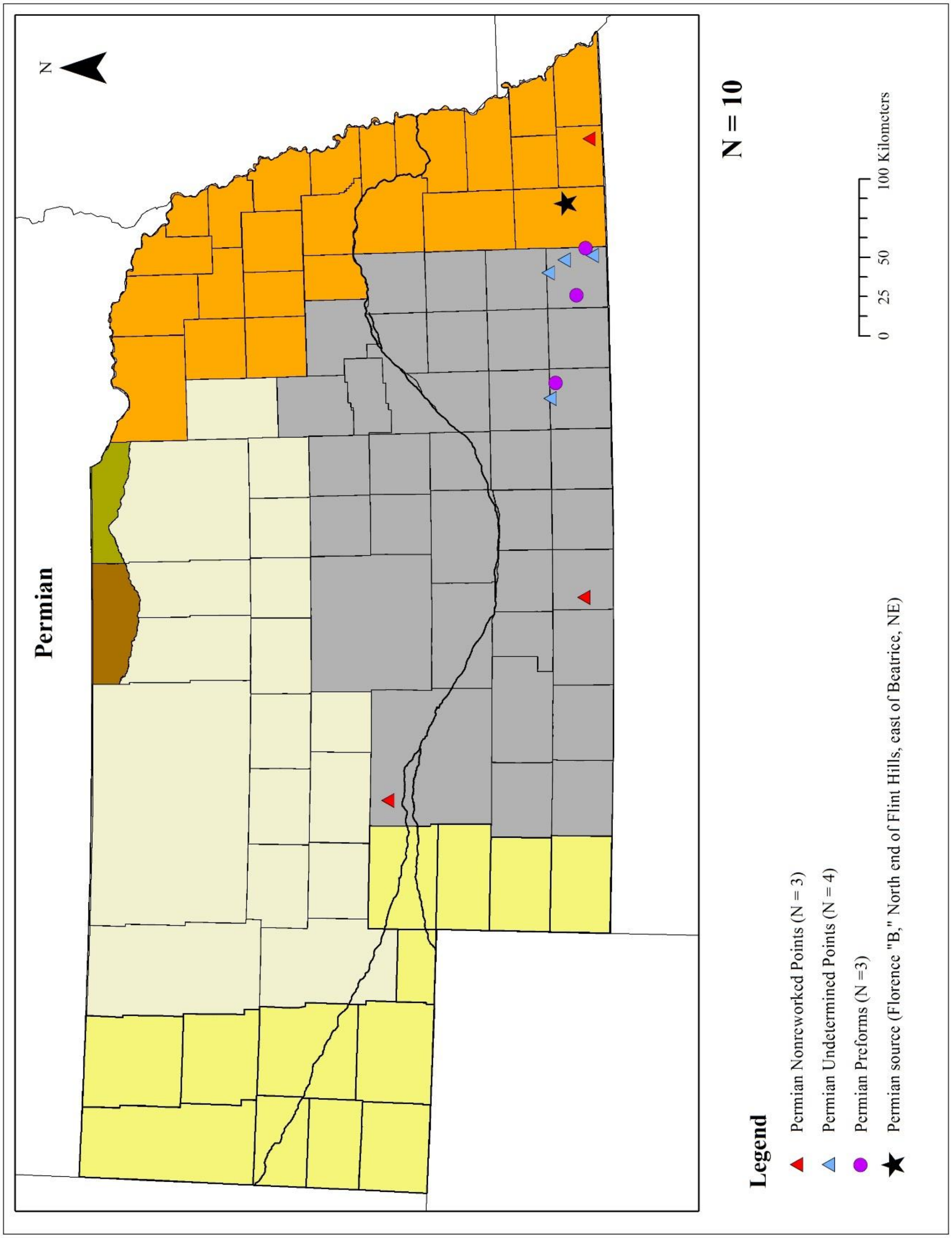

Figure 5.11: Permian Chert Distribution by Reduction Stage and Ecoregion

Fossil Wood Patterns

Sources of Fossil Wood are found in central Colorado and from residual secondary sources outwashed from the west. This study assumed the Westfall Folsom site in east-central Colorado as a primary Fossil Wood source area (Figure 5.12). The Westfall Folsom site is near a good source of Black Forest petrified wood hence using this site as the source provided a reasonable proxy source for determination of distances to source for Fossil Wood artifacts in this sample. However, the majority of the Fossil Wood artifacts in the Central Plains Folsom database are probably coming out of the Platte River Basin.

Twenty-two Fossil Wood artifacts are in the Nebraska Folsom sample making up 7.2% of the total sample (Figure 5.1). The artifacts types represented in the Fossil Wood sample are 14 Folsom points, 3 Midland points, 4 preforms, and 1 channel flake (Table 5.1). The total number of Fossil Wood projectile points (Folsom and Midland) is 17 and includes the following fragment types: 6 complete points, 8 point bases, 2 tips, and 1 blade (Table 5.2).

All Fossil Wood artifacts were found in the western half of Nebraska with the exception of one found in southeast Nebraska, in Nuckolls County (Figure 5.12). The largest concentration of Fossil Wood artifacts is from the North and South Platte River confluence in Keith (with 11 artifacts) and Lincoln (with 4 artifacts) counties (Table 5.13, Figure 5.12). The other Fossil Wood artifacts from western Nebraska were found in the following counties with one to two specimens each: Dawson, Deuel, Garden, Hooker, and McPherson. The northeastern part of Nebraska has no documented evidence of Folsom Fossil Wood artifacts (Figure 5.12).

Fossil Wood artifacts were found in three ecoregions in the western, north-central, and south-central parts of the state (Tables 5.4 and 5.15, Figure 5.13). But, most Fossil Wood Folsom artifacts were found in the South Platte River with 13 artifacts. The Western High Plains, Nebraska Sand Hills, and Central Great Plains had 1, 4, and 4 Fossil Wood artifacts respectively.

The North Platte River and eastern and northeastern ecoregions (Corn Belt Plains, Northwestern Great Plains, and Northwestern Glaciated Plains) had no documented evidence for Fossil Wood Folsom artifacts.

Fossil Wood: Patterns in Reduction Stages

Fossil Wood Preforms. The sample has a total of four Fossil Wood preforms from two counties. Keith County, at the heart of the confluence of the North and South Platte River confluence, has the majority of the Fossil Wood preform evidence with three preforms. One was found in Deuel County located in the western Nebraska panhandle next to Keith County (Table 5.14, Figure 5.12). Fossil Wood preforms were found 275 and 320 km from the Westfall site source. All four Fossil Wood preforms were found in the South Platte River streambed (Table 5.15, Figure 5.13).

Fossil Wood Channel Flakes. Table 5.14 and Figure 5.12 show the sample has one Fossil Wood channel flake found in Keith County found 320 km from the primary source. This channel flake was found in the South Platte River streambed (Table 5.15, Figure 5.13).

Fossil Wood Non-Reworked Projectile Points. The sample has six Fossil Wood non-reworked points (Table 5.14, Figure 5.12). Four of these were found in the North and South Platte River confluence with Keith County having three and Lincoln with one. The other two Fossil Wood non-reworked points were found in Garden and McPherson Counties located in western Nebraska above the North Platte River. Fossil Wood non-reworked points were found between 320 and 385 km from the source (Table 5.14). Fossil Wood non-reworked points were found in the South Platte River and in one ecoregion. The majority of the Fossil Wood non-reworked points were found in the South Platte River (with four artifacts), while the Nebraska Sand Hills had two Fossil Wood non-reworked points (Table 5.15, Figure 5.13).

Fossil Wood Reworked Projectile Points. The Fossil Wood sample had three reworked points, all of these were found in Keith and Lincoln Counties, in the heart of the North and South Platte Rivers confluence (Table 5.14, Figure 5.12). The Fossil Wood artifacts were found between 320 and 370 km from the Westfall site source area (Table 5.14). Table 5.15 and Figure 5.13 show the Fossil Wood reworked points were found in the South Platte River streambed (two artifacts) and the Central Great Plains ecoregion (one artifact).

Fossil Wood Undetermined Projectile Points. Eight Fossil Wood points were classified as undetermined in terms of reworking (Table 5.14, Figure 5.12). Half of these were found in the North and South Platte River confluence in Keith and Lincoln Counties. The other Fossil Wood undetermined points were found in western Nebraska (in Dawson, Hooker, and Garden Counties), while one was from south-central Nebraska in Nuckolls County. Fossil Wood undetermined points were found between 320 and 549 km from the Westfall site source area (Table 5.14). Undetermined points made of Fossil Wood were found in three ecoregions (Western High Plains, Nebraska Sand Hills, and Central Great Plains) and the South Platte River each having one to three specimens each (Table 5.15, Figure 5.13).

Table 5.13: All Other Material Types by County

	MATERIAL TYPE*								
COUNTY	**UC**	**FW**	**QZT**	**KRF**	**ALI**	**POR**	**ED**	**TRSS**	**TOTAL**
ARTHUR									**0**
BANNER	1								**1**
BLAINE									**0**
BOONE	1								**1**
BOX BUTTE									**0**
BROWN									**0**
CHASE	4				1				**5**
CHERRY	5			1					**6**
CUSTER	1								**1**
DAWES									**0**
DAWSON		1							**1**
DEUEL		1							**1**
DUNDY					1				**1**
FRANKLIN									**0**
GARDEN		2	1	1	1				**5**
GRANT	1								**1**
HALL	1								**1**
HARLAN				1			1		**2**
HITCHCOCK									**0**
HOOKER	2	1							**3**
JEFFERSON									**0**
KEITH	6	11	3		1	1	1	1	**24**
LANCASTER				1					**1**
LINCOLN	11	4		1	1				**17**
LOUP									**0**
MCPHERSON	3	1	1	1					**6**
MORRILL	1								**1**
NUCKOLLS	1	1							**2**
PAWNEE									**0**
RED WILLOW	2								**2**
SCOTTS BLUFF									**0**
SHERIDAN	2								**2**
SIOUX	2								**2**
THAYER									**0**
THOMAS	2								**2**
TOTALS	**46**	**22**	**5**	**6**	**5**	**1**	**2**	**1**	**88**

***UC = Unidentified Chert; FW = Fossil Wood; QZT = Quartzite; KRF = Knife River Flint; ALI = Alibates; POR = Porcellanite; ED = Edwards; TRSS = Tongue River Silicified Sediment**

Table 5.14: Fossil Wood Artifacts by Reduction Stage and County

	FOSSIL WOOD							
COUNTY	**REWORKED POINTS**	**NON-REWORKED POINTS**	**UNDETER-MINED POINTS**	**PREFORMS**	**CHANNELS**	**TOTAL # ARTIFACTS**	**DISTANCE TO PRIMARY SOURCE (KM)**	**% WITHIN THIS DISTANCE**
DAWSON			1			**1**	428	5%
DEUEL				1		**1**	275	5%
GARDEN		1	1			**2**	321	9%
HOOKER			1			**1**	408	5%
KEITH	2	3	2	3	1	**11**	320	50%
LINCOLN	1	1	2			**4**	370	18%
MCPHERSON		1				**1**	385	5%
NUCKOLLS			1			**1**	549	5%
TOTALS	**3**	**6**	**8**	**4**	**1**	**22**	**NA**	**100%**

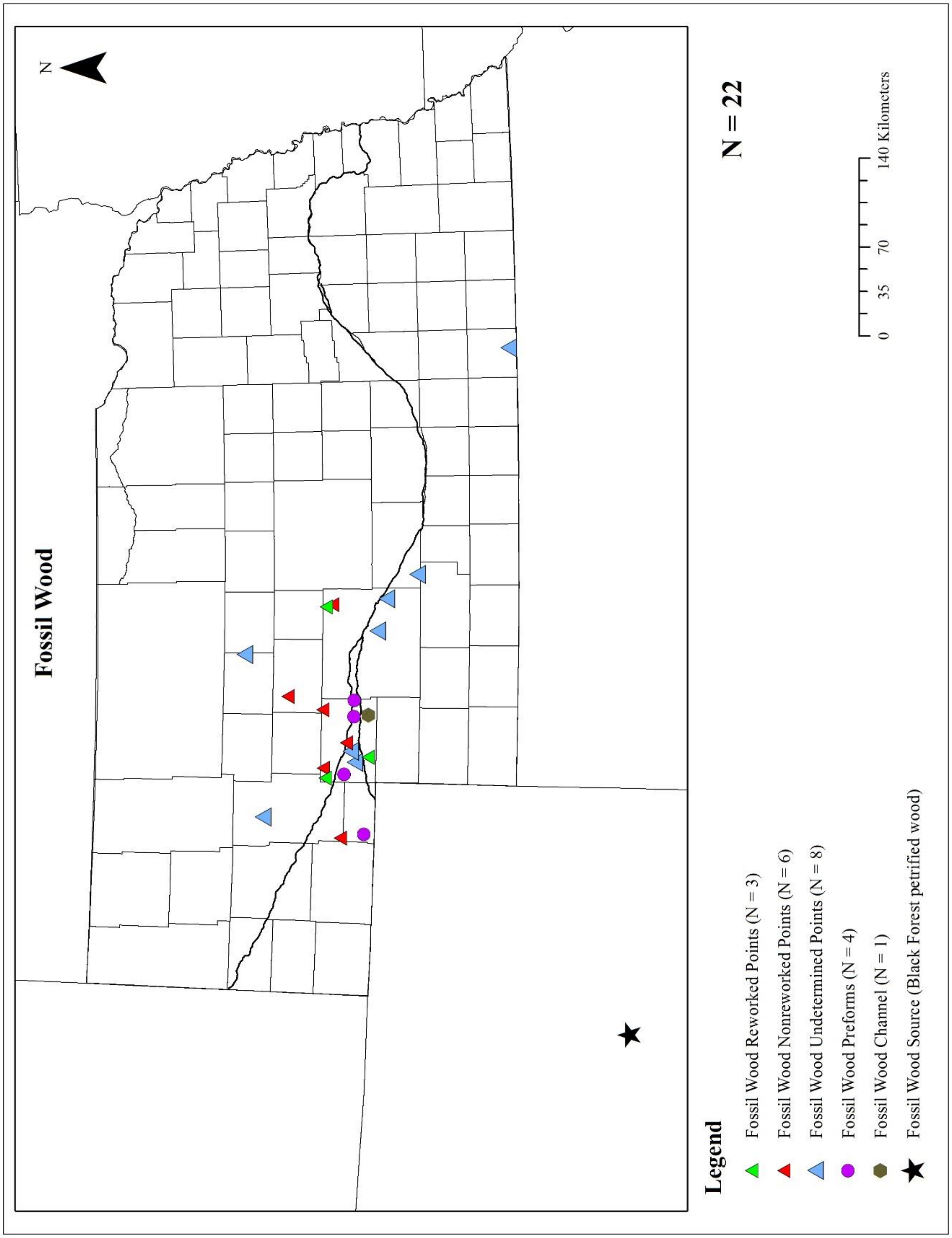

Figure 5.12: Fossil Wood Distribution by Reduction Stage and County

Table 5.15: Fossil Wood Artifacts by Reduction Stage and Ecoregion

	FOSSIL WOOD					
ECOREGION	**REWORKED POINTS**	**NON-REWORKED POINTS**	**UNDETER-MINED POINTS**	**PREFORMS**	**CHANNELS**	**TOTAL # ARTIFACTS**
WESTERN HIGH PLAINS	0	0	1	0	0	**1**
SOUTH PLATTE RIVER	2	4	2	4	1	**13**
NEBRASKA SAND HILLS	0	2	2	0	0	**4**
NORTH PLATTE RIVER	0	0	0	0	0	**0**
CENTRAL GREAT PLAINS	1	0	3	0	0	**4**
CORN BELT PLAINS	0	0	0	0	0	**0**
TOTALS	**3**	**6**	**8**	**4**	**1**	**22**

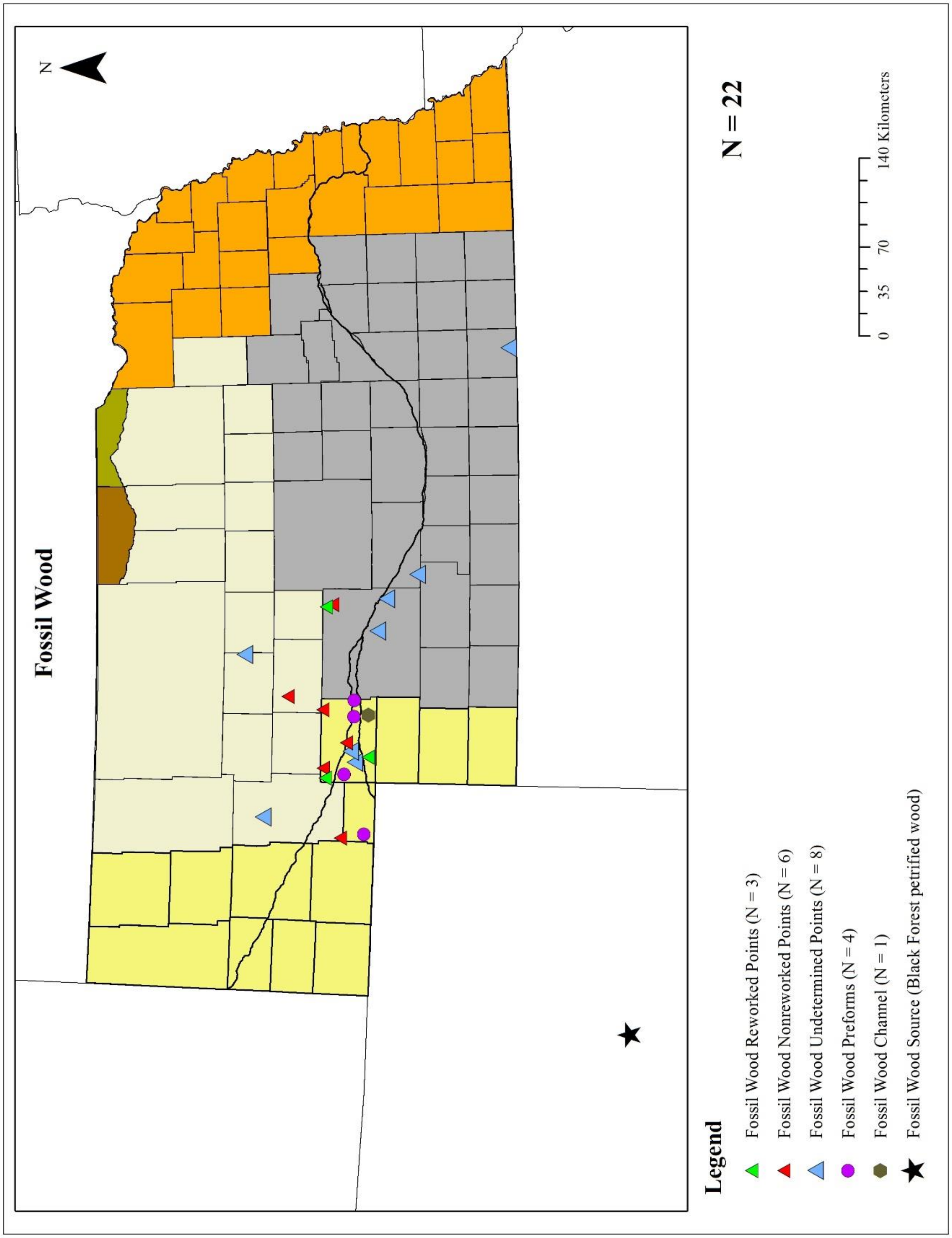

Figure 5.13: Fossil Wood Distribution by Reduction Stage and Ecoregion

Unidentified Lithic Materials Patterns

Forty-six of the artifacts in the Nebraska Folsom sample could not be identified as to lithic source (Figure 5.1). Some of these specimens were not seen other than in photographs or drawings and others simply could not be confidently identified to a specific lithic material. Unidentified lithic materials make up 15% of the total Nebraska Folsom sample. The artifacts made of unidentified lithic materials breakdown into the following artifact types: 39 Folsom points, 4 Midland points, and 3 preforms (Table 5.1). The total number of Folsom and Midland projectile points made of unidentified lithic materials is 43 and are classified into the following fragment types: 14 complete points, 12 point bases, 7 tips, and 7 blades, and 3 points where information was not available on fragment type (Table 5.2).

Artifacts made of unidentified lithic materials were found in 17 counties (Table 5.13, Figure 5.14). Most of these counties lie in the western half of Nebraska (Sioux, Sheridan, Cherry, Banner, Morrill, Grant, Hooker, Thomas, McPherson, Keith, Lincoln, Chase, and Red Willow). The other counties with artifacts made of unidentified lithic materials are in central (Custer County), south-central (Hall and Nuckolls Counties), and northeastern Nebraska (Boone County). The counties with the largest number of Folsom artifacts made of unidentified materials are Keith and Lincoln Counties at the confluence of the North and South Platte Rivers (Table 5.13, Figure 5.14).

Artifacts made of unidentified lithic materials are found in three ecoregions and the North and South Platte Rivers (Table 5.17, Figure 5.15). The ecoregions with the greatest evidence for artifacts made of unidentified lithic materials are the Nebraska Sand Hills and Central Great Plains with 15 and 16 specimens respectively. The Western High Plains had 10 specimens. The South Platte River streambed had three artifacts made of unidentified lithic materials and the North Platte had two. No Folsom artifacts made of unidentified lithic materials were found in the eastern (Corn Belt Plains) and the northeastern (Northwestern Great Plains and Northwestern Glaciated Plains) ecoregions.

Unidentified Chert: Patterns in Reduction Stages

In general, the unidentified chert artifacts in the Central Plains Folsom database tend to pattern like the overall pattern, with the exception that there are fewer unidentified chert artifacts coming out of the South Platte River than for White River Group Silicates and Hartville artifact samples. Also, two counties are represented in the unidentified chert artifacts—Boone and Hall. These counties are in eastern Nebraska, but they are in the Central Great Plains ecoregion. These two counties are not represented in the White River Group Silicates, Hartville, and Smoky Hill Jasper samples.

Unidentified Chert Preforms. The sample has three preforms made of unidentified lithic materials. Table 5.16 and Figure 5.14 show that of these came from the counties that lie in the confluence of the North and South Platte Rivers (Keith and Lincoln Counties). The preforms made of unidentified lithic materials came from the Western High Plains and the South Platte River streambed (Table 5.17, Figure 5.15). The Nebraska Sand Hills, Central Great Plains, Corn Belt Plains, Northwestern Glaciated Plains, Northwestern Great Plains, and North Platte River all had no evidence for preforms made of unidentified lithic materials.

Unidentified Channel Flakes. The sample had no evidence for channel flakes made of unidentified lithic materials (Tables 5.16 and 5.17).

Unidentified Chert Non-Reworked Projectile Points. The sample contains nine non-reworked points made of unidentified lithic materials from seven Nebraska counties (Table 5.16, Figure 5.14). The non-reworked points made of unidentified chert are distributed evenly between the northwest (Sioux), west (Hooker, Thomas, McPherson, Keith, and Lincoln) and central

(Custer) parts of the state. The unidentified chert non-reworked points are from three ecoregions and the North Platte River (Table 5.17, Figure 5.15). The Nebraska Sand Hills with four non-reworked points had the most evidence, while the Western High Plains and Central Great Plains had two each. The North Platte River had one non-reworked point. No evidence for non-reworked points made of unidentified lithic materials were found in the South Platte, Northwestern Glaciated Plains, Northwestern Great Plains, or Corn Belt Plains.

Unidentified Chert Reworked Projectile Points. Table 5.16 and Figure 5.14 show the sample has nine reworked points made of unidentified lithic material and these occur in seven Nebraska counties. The reworked points made of unidentified lithic materials were found in the northwest (Sheridan, Cherry, McPherson Counties), southwest (Red Willow), south-central (Hall and Nuckolls), and northeast (Boone) parts of the state. The reworked points made of unidentified lithic materials occur in two ecoregions—the Central Great Plains with five of these and the Nebraska Sand Hills with four (Table 5.17, Figure 5.15). The Western High Plains, Corn Belt Plains, Northwestern Glaciated Plains, Northwestern Great Plains, and the North and South Platte River had no evidence of reworked points made of unidentified materials.

Unidentified Chert Undetermined Projectile Points. Twenty-five points made of unidentified lithic materials were classified as undetermined in terms of reworking. Table 5.16 and Figure 5.14 show these came from 11 counties in the northwestern (Sioux, Banner, Morrill, Sheridan, Cherry, Grant, Hooker, and McPherson) and southwestern (Chase) parts of the state, and the North and South Platte River confluence (Keith and Lincoln). Lincoln County had the most evidence with nine undetermined points made of unidentified lithic materials. The undetermined points made of unidentified lithic materials were found in three ecoregions and the North and South Platte Rivers. The Nebraska Sand Hills, Western High Plains, and Central Great

Plains each had seven to nine of these, while the North and South Platte Rivers each had one (Table 5.17, Figure 5.15). No evidence for undetermined points made of unidentified chert were found in the eastern and northeastern ecoregions (Corn Belt Plains, Northwestern Glaciated Plains, and Northwestern Great Plains).

Table 5.16: Unidentified Chert by Reduction Stage and County

	UNIDENTIFIED CHERT					
COUNTY	**REWORKED POINTS**	**NON-REWORKED POINTS**	**UNDETER-MINED POINTS**	**PREFORMS**	**CHANNELS**	**TOTAL # ARTIFACTS**
BANNER			1			**1**
BOONE	1					**1**
CHASE			4			**4**
CHERRY	2		3			**5**
CUSTER		1				**1**
GRANT			1			**1**
HALL	1					**1**
HOOKER		1	1			**2**
KEITH		2	2	2		**6**
LINCOLN		1	9	1		**11**
MCPHERSON	1	1	1			**3**
MORRILL			1			**1**
NUCKOLLS	1					**1**
RED WILLOW	2					**2**
SHERIDAN	1		1			**2**
SIOUX		1	1			**2**
THOMAS		2				**2**
TOTALS	**9**	**9**	**25**	**3**	**0**	**46**

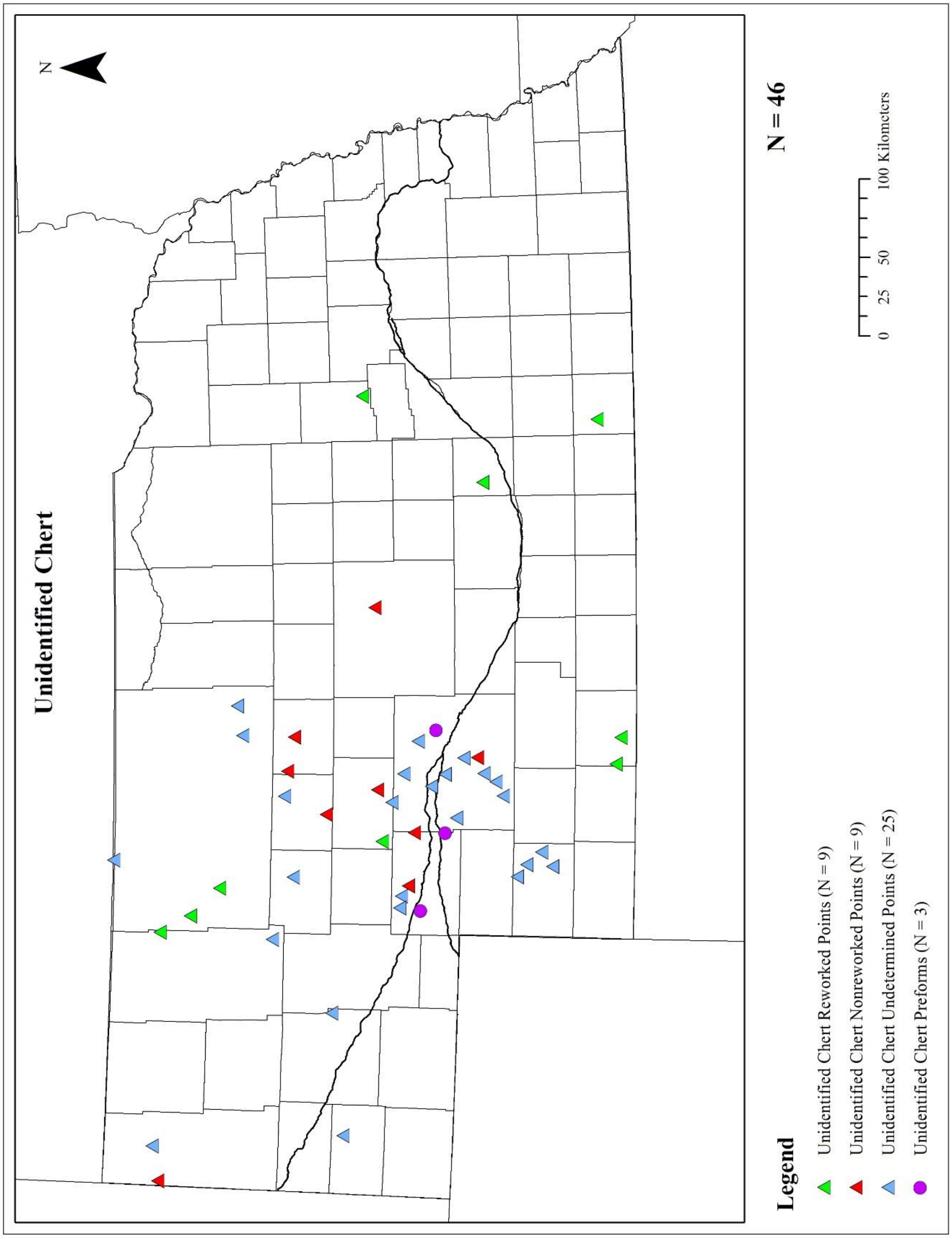

Figure 5.14: Unidentified Chert Distribution by Reduction Stage and County

Table 5.17: Unidentified Chert by Reduction Stage and Ecoregion

	UNIDENTIFIED CHERT					
ECOREGION	REWORKED POINTS	NON-REWORKED POINTS	UNDETER-MINED POINTS	PREFORMS	CHANNELS	TOTAL # ARTIFACTS
WESTERN HIGH PLAINS	0	2	7	1	0	**10**
SOUTH PLATTE RIVER	0	0	1	2	0	**3**
NEBRASKA SAND HILLS	4	4	7	0	0	**15**
NORTH PLATTE RIVER	0	1	1	0	0	**2**
CENTRAL GREAT PLAINS	5	2	9	0	0	**16**
CORN BELT PLAINS	0	0	0	0	0	**0**
TOTALS	**9**	**9**	**25**	**3**	**0**	**46**

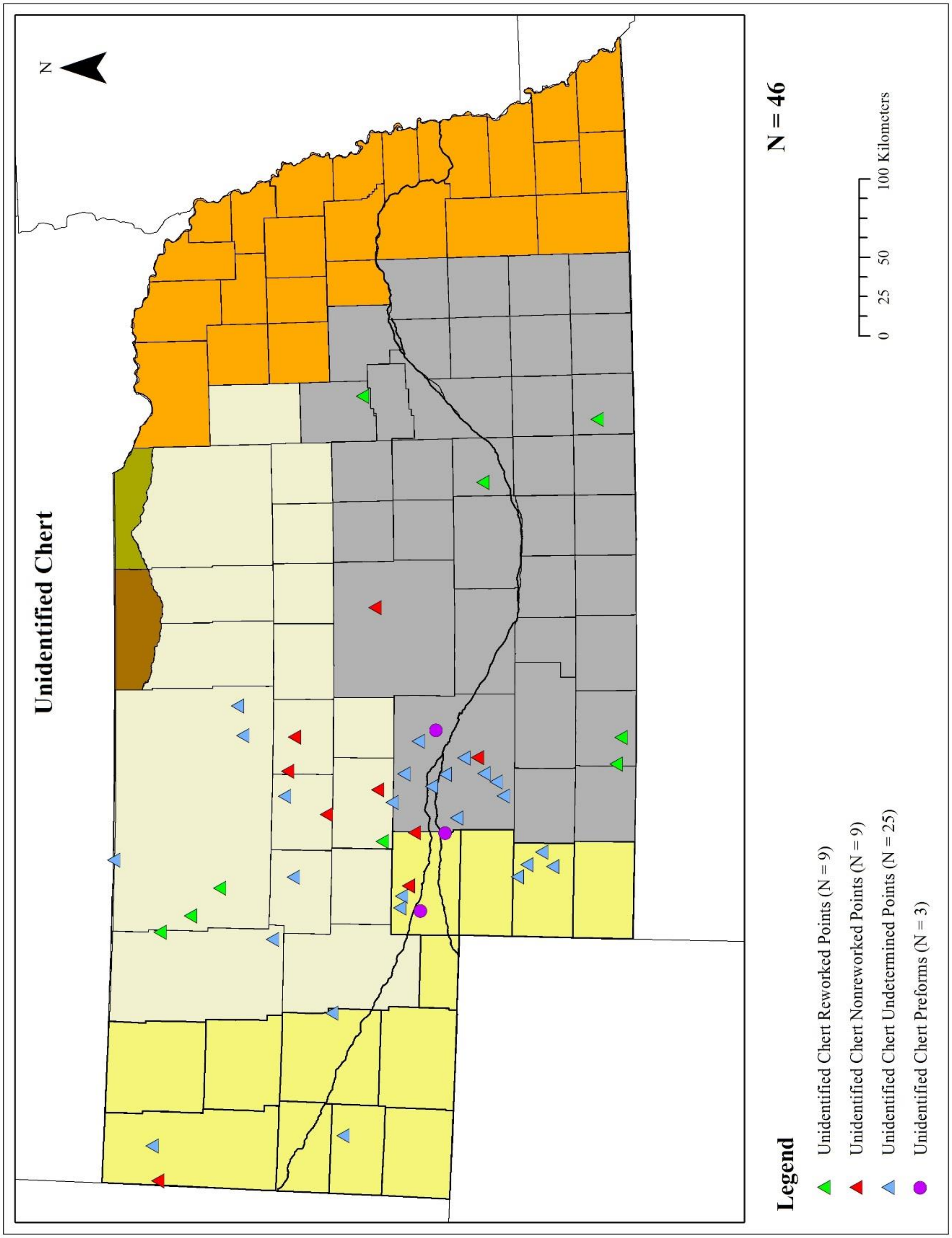

Figure 5.15: Unidentified Chert Distribution by Reduction Stage and Ecoregion

Quartzite Patterns

Quartzite was moved in an eastward direction from the likely sources of Spanish Diggings or Cloverly quartzite found in the Hartville Uplift of east central Wyoming and Dakota quartzite from the Dakota Formation in the southeast Colorado area (distances from these sources were not calculated). The Nebraska Folsom sample contains five artifacts made of quartzite, making up only 1.6% of the total sample (Figure 5.1). Table 5.1 shows all five quartzite artifacts in the sample are Folsom points. These points include the following fragment types: 1 complete point, 2 point bases, 1 tip, and 1 blade (Table 5.2).

Table 5.13 and Figures 5.16 and 5.17 show quartzite projectile points were found in three counties (Garden, McPherson, and Keith). The largest evidence was in Keith County with three quartzite points. Garden and McPherson Counties are in northwest Nebraska and had one quartzite point each. Tables 5.4 and 5.19 and Figures 5.18 and 5.19 show quartzite projectile points were found in two ecoregions (the Nebraska Sand Hills with two and the Western High Plains with three). No quartzite points were found in the North or South Platte Rivers nor in the Central Great Plains or eastern and northeastern ecoregions (the Corn Belt Plains, Northwestern Glaciated Plains, and Northwestern Great Plains).

Quartzite: Patterns in Reduction Stages

Quartzite Preforms and Channel Flakes. No evidence for quartzite preforms or channel flakes was documented in the Nebraska Folsom sample (Tables 5.18 and 5.19, Figures 5.16, 5.17, 5.18, and 5.19).

Quartzite Non-Reworked Projectile Points. The sample has one quartzite non-reworked point from Keith County (Table 5.18, Figures 5.16 and 5.17). This point was found in the Western High Plains ecoregion (Table 5.19, Figures 5.18 and 5.19).

Quartzite Reworked Projectile Points. The sample has no quartzite reworked points (Tables 5.18 and 5.19, Figures 5.16, 5.17, 5.18, and 5.19).

Quartzite Undetermined Projectile Points. The sample has four quartzite undetermined (in terms of reworking) points. One of these is from Garden County, two from Keith County, and one from McPherson (Table 5.18, Figures 5.16 and 5.17). The quartzite undetermined points came from two ecoregions—the Nebraska Sand Hills had two and the Western High Plains had two (Table 5.19, Figures 5.18 and 5.19).

Table 5.18: All Lesser Material Types by Reduction Stage and by County

	ALL LESSER MATERIAL TYPES							
COUNTY	**REWORKED POINTS**	**NON-REWORKED POINTS**	**UNDETER-MINED POINTS**	**PREFORMS**	**CHANNELS**	**TOTAL # ARTIFACTS**	**DISTANCE TO PRIMARY SOURCE (KM)**	**% WITHIN THIS DISTANCE**
CHASE	1 ALI					1 ALI	(534 ALI)	(20%, ALI)
CHERRY	1 KRF					1 KRF	(536 KRF)	(17%, KRF)
DUNDY			1 ALI			1 ALI	(495 ALI)	(20% ALI)
GARDEN			1 ALI, 1 KRF, 1 QZT			1 ALI, 1 KRF, 1 QZT	(639 KRF), (659 ALI), (NA QZT)	(20%, ALI), (17%, KRF), (NA, QZT)
HARLAN	1 KRF	1 ED				1 KRF, 1 ED	(818 KRF), (834 ED)	(17%, KRF), (50%, ED)
KEITH		1 ALI, 1 QZT	2 QZT, 1 POR	1 ED, 1 TRSS		3 QZT, 1 POR, 1 ALI, 1 ED, 1 TRSS	(609 ALI), (446 POR), (954 ED), (NA, QZT), (NA, TRSS)	(NA, QZT), (100%, POR), (20%, ALI), (50%, ED), (NA, TRSS)
LANCASTER	1 KRF					1 KRF	(832 KRF)	(17%, KRF)
LINCOLN		1 ALI, 1 KRF				1 ALI, 1 KRF	(596 ALI), (704 KRF)	(20%, ALI), (17%, KRF)
MCPHERSON			1 QZT, 1KRF			1 QZT, 1 KRF	(644 KRF), (NA, QZT)	(NA, QZT), (17% KRF)
TOTALS	**1 ALI, 3 KRF**	**1 ED, 2 ALI, 1 QZT, 1 KRF**	**2 ALI, 2 KRF, 4 QZT, 1 POR**	**1 ED, 1 TRSS**		**(5 QZT), (6 KRF), (5 ALI), (1 POR), (2 ED), (1 TRSS)**	**NA**	**NA**
Abbreviations Stand for: QZT = Quartzite; KRF = Knife River Flint; ALI = Alibates; POR = Porcellanite; ED = Edwards; TRSS = Tongue River Silicified Sediment								

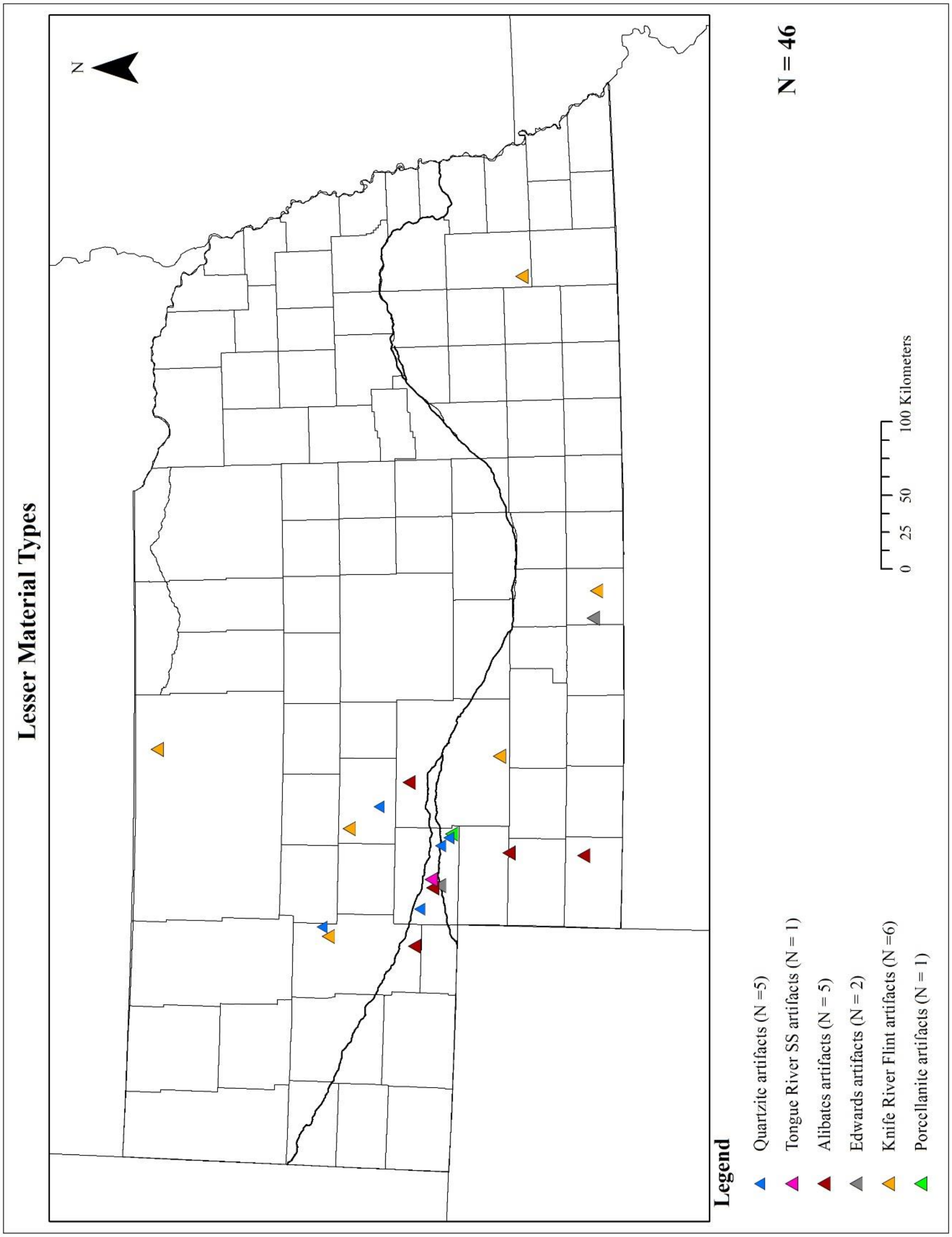

Figure 5.16: Lesser Material Types Distribution by County

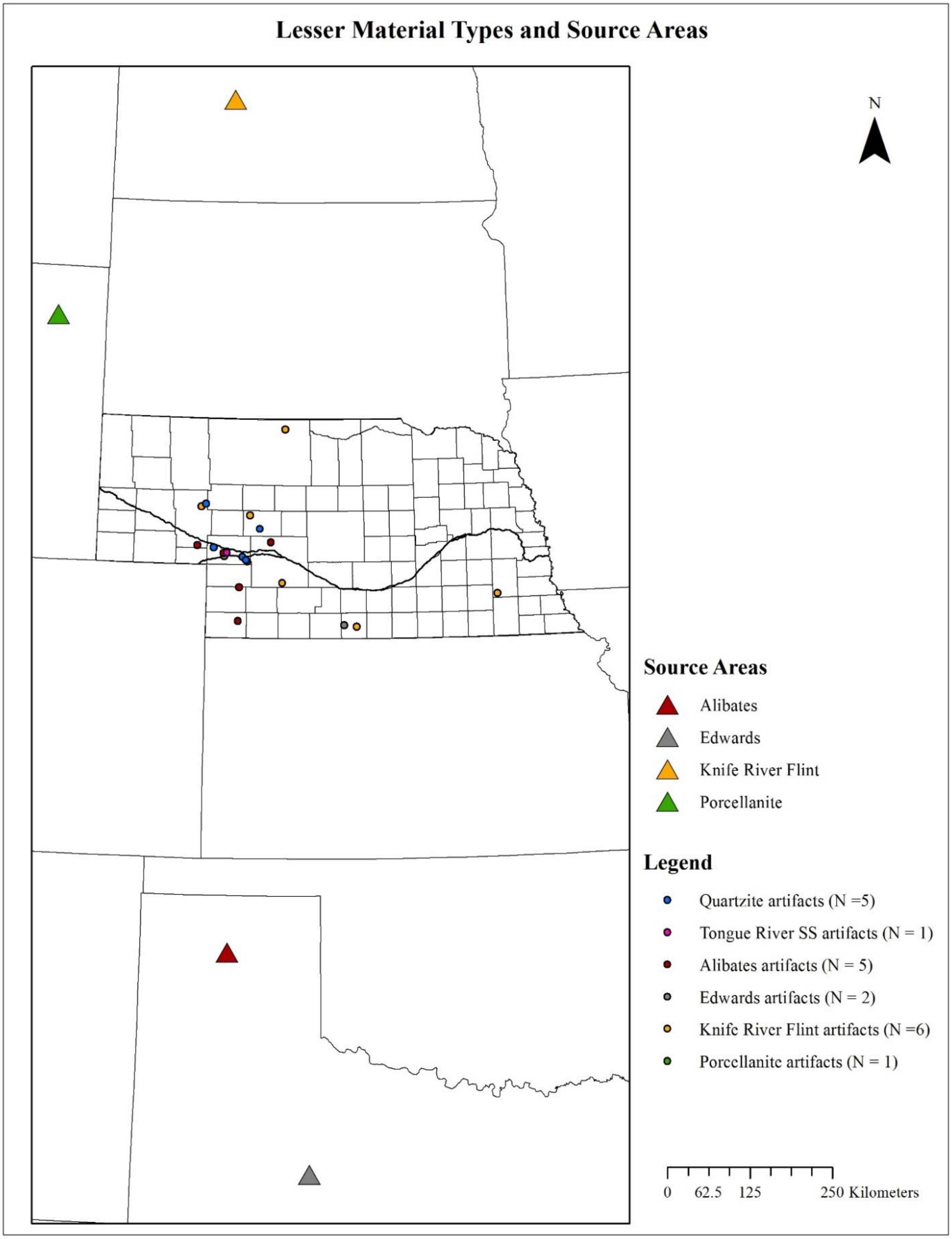

Figure 5.17: Lesser Material Types and Sources showing County Boundaries

Table 5.19: All Lesser Materials by Reduction Stage and Ecoregion

	ALL LESSER MATERIAL TYPES					
ECOREGION	**REWORKED POINTS**	**NON-REWORKED POINTS**	**UNDETER-MINED POINTS**	**PREFORMS**	**CHANNELS**	**TOTAL # ARTIFACTS**
WESTERN HIGH PLAINS	1 ALI	1 ALI, 1 QZT	1 ALI, 2 QZT, 1 POR	1 ED		**3 ALI, 3 QZT, 1 POR, 1 ED**
SOUTH PLATTE RIVER				1 TRSS		**1 TRSS**
NEBRASKA SAND HILLS	1 KRF		1 ALI, 2 QZT, 2 KRF			**1 ALI, 3 KRF, 2 QZT**
NORTH PLATTE RIVER						**NONE**
CENTRAL GREAT PLAINS	1 KRF	1 ALI, 1 ED, 1 KRF				**2 KRF, 1 ALI, 1 ED**
CORN BELT PLAINS	1 KRF					**1 KRF**
TOTALS	**1 ALI, 3 KRF**	**1 ED, 2 ALI, 1 QZT, 1 KRF**	**2 ALI, 2 KRF, 4 QZT,1 POR**	**1 ED, 1 TRSS**	**NONE**	**(5 QZT), (6 KRF), (5 ALI), (1 POR), (2 ED), (1 TRSS)**
Abbreviations Stand for: QZT = Quartzite; KRF = Knife River Flint; ALI = Alibates; POR = Porcelanite; ED = Edwards; TRSS = Tongue River Silicified Sediment						

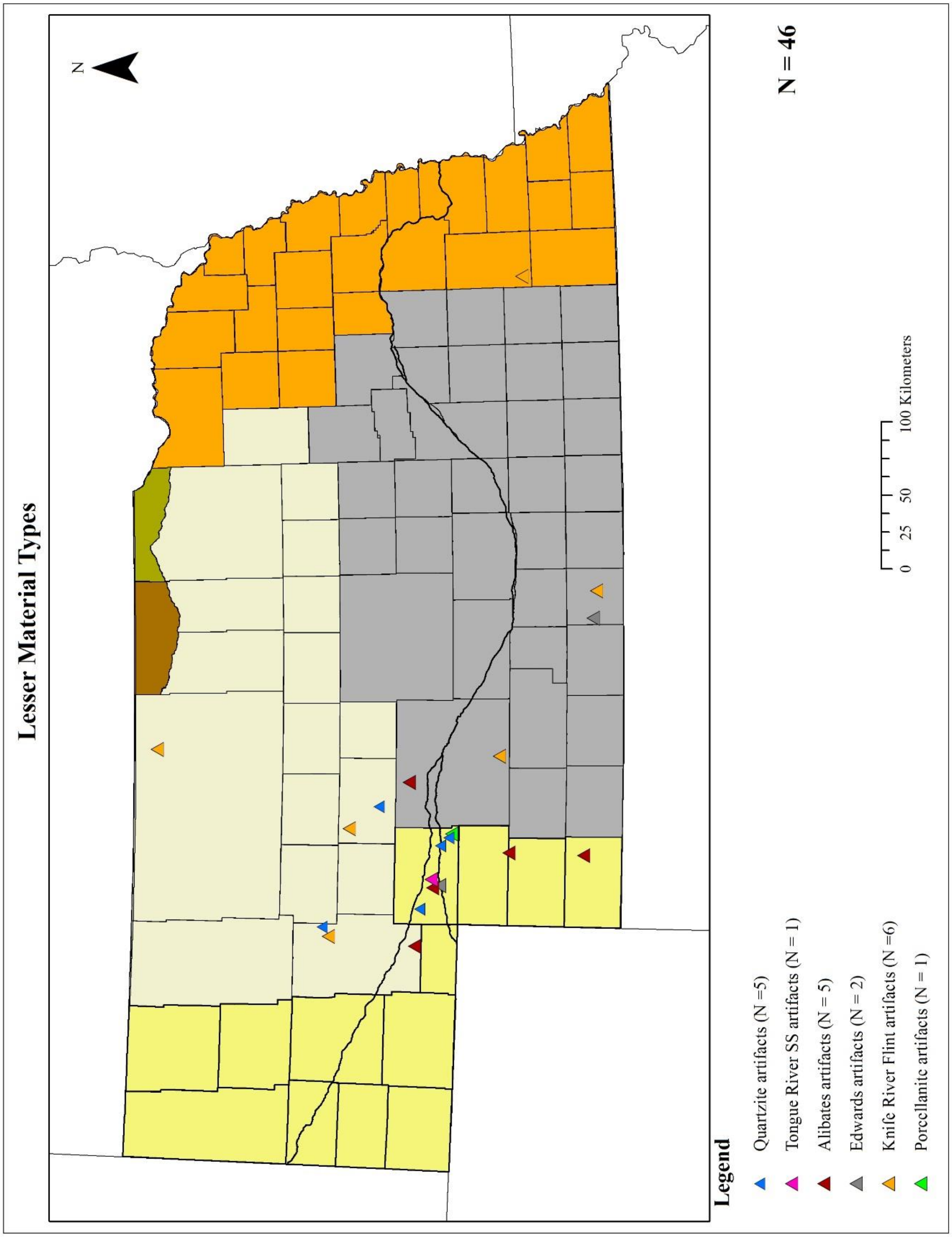

Figure 5.18: Lesser Material Types Distribution by Ecoregion

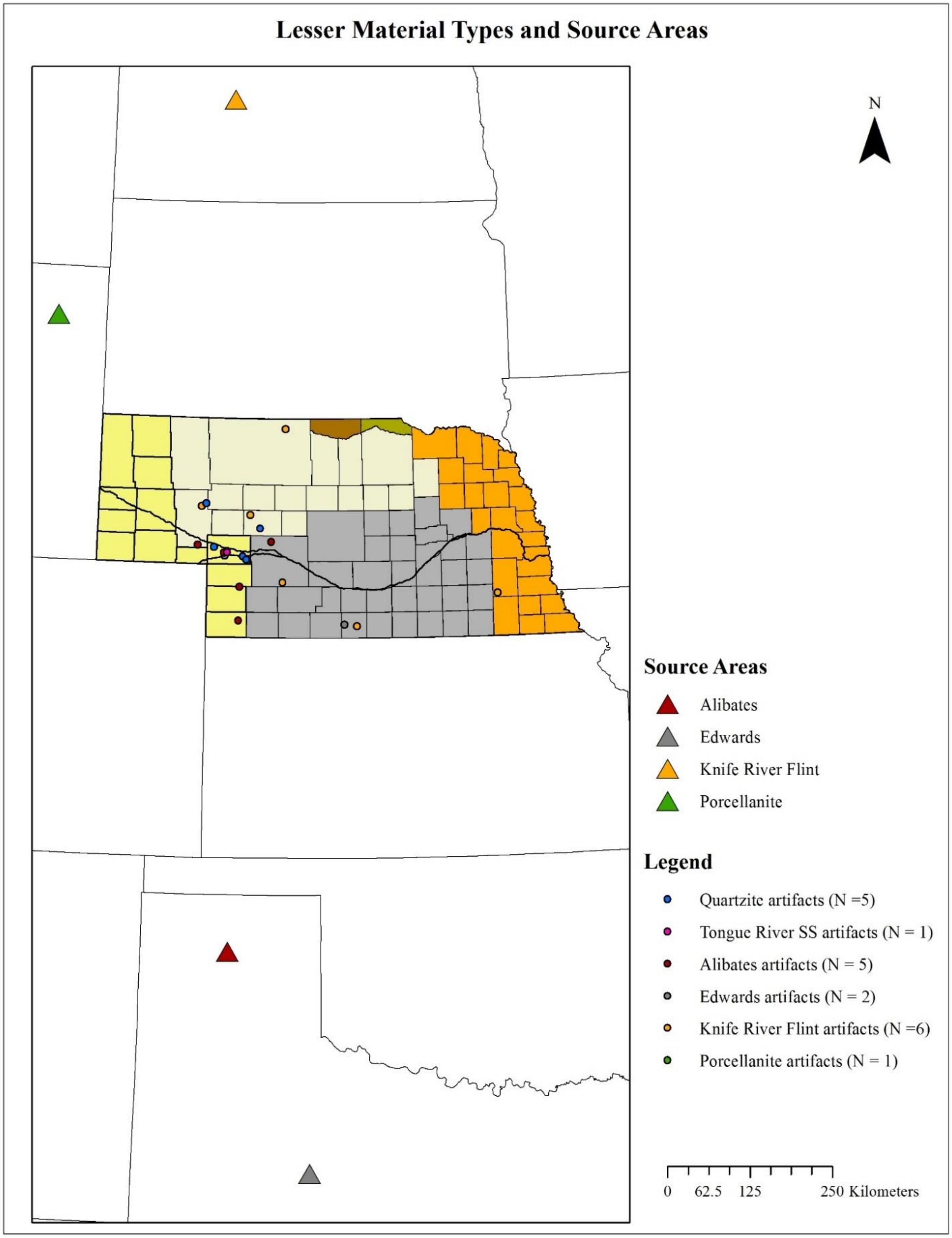

Figure 5.19: Lesser Material Types and Sources showing Ecoregion

Knife River Flint Patterns

The Knife River Flint source is in west-central North Dakota (Figure 5.17). The Nebraska Folsom sample has six artifacts made of this material, making up 2% of the total sample (Figure 5.1). The maximum distance it was moved from the source was 832 km to Lancaster County located in southeastern Nebraska (Table 5.18, Figure 5.16). The shortest distance from the source was 536 km to Cherry County located in north-central Nebraska near the border with South Dakota. The artifact types for the Knife River Flint sample include five Folsom points and one Midland point (Table 5.1). The Knife River Flint Folsom and Midland point fragment types include: three complete points, two point bases, and one tip (Table 5.2).

Knife River Flint occurs in six Nebraska counties (Tables 5.13 and 5.18, Figure 5.16). Table 5.18 and Figure 5.16 shows four Knife River Flint Folsom artifacts are found in the western half of Nebraska (in Cherry County located in northwest Nebraska, Garden and McPherson Counties in west-central Nebraska, and Lincoln County in the confluence of the North and South Platte Rivers). Knife River Flint Folsom artifacts are also found in south-centrally located Harlan County and Lancaster County in southeastern Nebraska. The northeastern part of Nebraska has no Knife River Flint Folsom artifacts.

Knife River Flint Folsom artifacts are found in three ecoregions (Tables 5.4 and 5.19, Figures 5.18 and 5.19). The ecoregions with Knife River Flint artifacts are the Nebraska Sand Hills, south-centrally located Central Great Plains, and Corn Belt Plains located in eastern Nebraska. No Knife River Flint artifacts were found in the northeastern ecoregions (the Northwestern Glaciated Plains and Northwestern Great Plains).

Knife River Flint: Patterns in Reduction Stages

Knife River Flint Preforms and Channel Flakes. No evidence for Knife River Flint Preforms or Channel Flakes was documented in the sample (Tables 5.18 and 5.19).

Knife River Flint Non-Reworked Projectile Points. The sample contained one Knife River Flint non-reworked points from Lincoln County in the confluence of the North and South Platte Rivers at a distance of 704 km (Table 5.18, Figures 5.16 and 5.17). This Knife River Flint non-reworked point was found in the Central Great Plains (Table 5.19 and Figures 5.18 and 5.19).

Knife River Flint Reworked Projectile Points. The sample had three Knife River Flint reworked projectile points found in Cherry (in northwest Nebraska), Harlan (in south-central Nebraska) and Lancaster (in southeastern Nebraska) Counties (Table 5.18, Figures 5.16 and 5.17). The distance to source ranged from 536 km in Cherry County to 832 km in Lancaster County (Table 5.18). Table 5.19 and Figures 5.18 and 5.19 show that Knife River Flint reworked points were found in three ecoregions (the Nebraska Sand Hills, Central Great Plains and Corn Belt Plains).

Knife River Flint Undetermined Projectile Points. Table 5.18 and Figures 5.16 and 5.17 show the sample contains two Knife River Flint undetermined points from Garden and McPherson Counties. The one from Garden County was found 639 km from the source while the one from McPherson was 644 km (Table 5.18). Table 5.19 and Figures 5.18 and 5.19 show that Knife River Flint undetermined points were found in the Nebraska Sand Hills.

Alibates Agatized Dolomite Patterns

The Alibates source area is in the central Texas Panhandle (Figure 5.17). The Nebraska Folsom sample has five Alibates artifacts making up 1.6% of the total sample (Figure 5.1). The maximum distance from the source to where it was found was 659 km to Garden County while the minimum distance was 495 km to Dundy County (Table 5.18, Figures 5.16 and 5.17). The artifact types for the Alibates sample include three Folsom points and two Midland points (Table 5.1). The Alibates Folsom and Midland point fragment types include: two complete points, two point bases, and one blade (Table 5.2).

Alibates Folsom and Midland points occur in five Nebraska counties—Chase, Dundy, Garden, Keith, and Lincoln (Table 5.13, Figure 5.16). All of these counties are located in western Nebraska with Keith and Lincoln at the confluence of the North and South Platte Rivers, Garden is in west-central Nebraska, and Chase and Dundy in the southwestern Nebraska Panhandle (Figure 5.16). The Nebraska Folsom Alibates artifacts are found in three ecoregions (Tables 5.4 and 5.19, Figures 5.18 and 5.19). Three Alibates artifacts were from the Western High Plains, one from the Nebraska Sand Hills, and one from the Central Great Plains. No evidence was documented for Alibates in the eastern and northeastern ecoregions (the Corn Belt Plains, Northwestern Glaciated Plains, and Northwestern Great Plains) nor in the North and South Platte River streambeds.

Alibates Agatized Dolomite: Patterns in Reduction Stages

Alibates Preforms and Channel Flakes. The Nebraska Folsom sample had no documented evidence of Alibates preforms or channel flakes (Tables 5.18 and 5.19).

Alibates Non-Reworked Projectile Points. The Alibates sample contained two non-reworked points and these were found in the confluence of the North and South Platte Rivers in Keith and Lincoln Counties at a distance of 609 and 596 km from the source respectively (Table 5.18, Figures 5.16 and 5.17). The Alibates point from Keith County is in the Western High Plains ecoregion while the one from Lincoln County is in the Central Great Plains (Table 5.19, Figures 5.18 and 5.19).

Alibates Reworked Projectile Points. The sample had one Alibates reworked point. This points was found in Chase County in the southwestern Nebraska Panhandle at a distance of 534 km from the source (Table 5.18, Figures 5.16 and 5.17). The Alibates reworked point was found in the Western High Plains (Table 5.19, Figures 5.18 and 5.19).

Alibates Undetermined Projectile Points. The sample contains two Alibates undetermined points in terms of reworking from Dundy and Garden Counties (Table 5.18, Figures 5.16 and 5.17). The one from Garden County was found 659 km from the source while the one from Dundy County was found 495 km from the source (Table 5.18). The Alibates undetermined points were found in the Nebraska Sand Hills and Western High Plains ecoregions (Table 5.19, Figures 5.18 and 5.19).

Edwards Chert Patterns

The source for Edwards chert is found in central Texas (Figures 5.17 and 5.19). Figure 5.1 shows that the Nebraska Folsom sample contains two artifacts made of Edwards chert making up 0.7% of the total sample. The maximum distance it was moved was 954 km to Keith County, while the other Edwards chert artifact was found 834 km from the source in Harlan County (Table 5.18, Figures 5.16 and 5.17). The artifact types for the Edwards chert artifacts are one Folsom point and one preform (Table 5.1). The Edwards Folsom point is a projectile point base (Table 5.2).

Edwards chert occurs in two Nebraska counties—Keith County near the confluence of the North and South Platte Rivers has one Edwards chert Folsom artifact and Harlan County located in south-central Nebraska also has one (Tables 5.13 and 5.18, Figures 5.16 and 5.17). The Edwards chert sample is found in two ecoregions—the Western High Plains and Central Great Plains (Tables 5.4 and 5.19, Figures 5.18 and 5.19).

Edwards Chert: Patterns in Reduction Stages

Edwards Chert Preform. The single Edwards chert preform was found in Keith County at a distance of 954 km from the source (Table 5.18, Figures 5.16 and 5.17). This preform was found in the Western High Plains ecoregion (Table 5.19, Figures 5.18 and 5.19).

Edwards Chert Non-Reworked Projectile Point. The sample had one Edwards non-reworked point from Harlan County located in south-central Nebraska (Table 5.18, Figures 5.16 and 5.17). This non-reworked point was found 834 km from the source (Table 5.18). The Edwards non-reworked point was found in the Central Great Plains (Table 5.19, Figures 5.18 and 5.19).

Edwards Chert Reworked Projectile Points, Undetermined Projectile Points, and Channel Flakes. No evidence for Edwards chert reworked points, undetermined points, or channel flakes was documented in the Nebraska Folsom sample (Tables 5.18 and 5.19).

Porcellanite Patterns

Figures 5.17 and 5.19 show the closest source of Porcellanite is in the Fort Union Formation in the Powder River Basin in Wyoming thus this was used to determine distance from source (Fredlund 1976). Porcellanite also outcrops in the Fort Union Formation in south-central Montana. The Nebraska Folsom sample has one artifact made of Porcellanite and this makes up 0.3% of the total sample (Figure 5.1). The Porcellanite artifact was moved 446 km (Table 5.18, Figures 5.16 and 5.17). The Porcellanite artifact is a Midland projectile point base (Tables 5.1 and 5.2). Figure 5.16 and Table 5.18 show that the Porcellanite Midland artifact was found in Keith County which is near the confluence of the North and South Platte Rivers. This artifact was found in the Western High Plains (Tables 5.4 and 5.19, Figures 5.18 and 5.19).

Porcellanite: Patterns in Reduction Stages

Porcellanite Reworked Projectile Points, Non-Reworked Points, Preforms, Channel Flakes. The sample has no documented evidence for Porcellanite reworked and non-reworked points, preforms, or channel flakes.

Porcellanite Undetermined Projectile Points. The sample has one Porcellanite undetermined point (in terms of reworking). It was found in Keith County which is in the Western High Plains 446 km from the source (Tables 5.18 and 5.19, Figures 5.16, 5.17, 5.18, and 5.19).

Tongue River Silicified Sediment (TRSS) Patterns

Tongue River Silicified Sediment (TRSS) occurs from the Moreau River in northeastern South Dakota to the Heart River in southwestern North Dakota (Ahler 1977; Keyser and Fagan 1987). TRSS is also found in cobble form in northeast Colorado (Holen 2001). But, material that is indistinguishable from TRSS occurs as gravels in Nebraska. The Nebraska Folsom sample has one TRSS artifact making up 0.3% of the sample (Figure 5.1). This single TRSS artifact is a preform (Table 5.1). It was found in Keith County in the South Platte River streambed (Tables 5.13, 5.18, and 5.19, Figures 5.16 and 5.17).

Tongue River Silicified Sediment (TRSS): Patterns in Reduction Stages

TRSS Preforms. As previously stated, the TRSS preform was found in Keith County in the South Platte River streambed (Tables 5.18 and 5.19, Figures 5.16 and 5.17).

TRSS Non-Reworked, Reworked, and Undetermined Projectile Points, and Channel Flakes. The Nebraska Folsom sample has no documented evidence of TRSS reworked, non-reworked, and undetermined projectile points, or channel flakes (Tables 5.18 and 5.19, and Figures 5.16, 5.17, 5.18, and 5.19).

Chapter 6: Folsom Land Use and Technological Organization in the Central Plains: What Do the Patterns Mean?

This chapter investigates the relevance of the Central Plains Folsom dataset to addressing models that have been offered about Folsom technological organization and land use by Amick (1994, 1996), Sellet (2013), and Hofman (2003). The chapter provides a description of these models and then gives their possible scenarios for the Central Plains. In addition, a description is given of the Central Plains Folsom dataset and what it represents along with a consideration of how this study's dataset, given previous models of Folsom land use and technological organization—Amick (1994, 1996), Sellet (2013), and Hofman (2003)—supports, enhances, or varies from the expectations of the models. Finally, it ends with a brief summary of how this study contributes to our understanding of Folsom land use.

Some Previous Folsom Technological Organization and Land Use Models and Scenarios for Those Models for the Central Plains Folsom Dataset

Amick's (1994; 1996) Model. A previous model for Folsom land use in the Southwest and Southern Plains is Amick's (1994; 1996) model. In it he proposes that Folsom occupation was focused on the margins, as opposed to the heart of the Plains grasslands (Amick 1994:426). In the model, Folsom occupation in the Southern Plains was largely logistical. They were using the Southern High Plains mainly for hunting, and the Basin and Range of the Southwest was characterized by a residential land use strategy. Amick's (1996:415) model estimated a seasonal round for Folsom groups in the American Southwest where Folsom hunters geared up at Edwards chert sources before heading out to exploit the Southern Plains and then returned to the Tularosa Basin (an intermontane basin of the Rio Grande Valley in the Basin and Range). A caveat to this model is that Folsom groups used the High Plains from both directions, but had very little western source lithic material on the Southern High Plains.

Amick's model suggests that overall the Folsom settlement system and mobility is "forager-based," but it also has a logistical hunting strategy (Amick 1996:423). He argues that the Basin and Range may have been used in a collector-style manner; whereas the Southern Plains may have been used seasonally (possibly during the summer to fall) in a forager style manner. Amick (1994:430) argues that Folsom residential camps are mostly associated with wetlands (on the Plains) and grassland-forest margins (such as in the Basin and Range where patches of grasslands lie next to forested mountains). The reasons for this may be that these areas buffer the risk of a subsistence strategy which incorporates hunting large animals such as bison (in cases of a failed hunt). Also, wetlands and grassland-forest margins are plentiful in small game and plant resources.

Amick's (1994; 1996) model suggests that high projectile point to preform ratios are indicative of a logistical land use strategy on the Southern Plains, whereas low point to preform ratios (where a higher proportion of preforms exist) is more indicative of a residential land use strategy in the Basin and Range area of the Southwest. In contrast, Hofman (1999:403) interprets Folsom technology as doing logistical and residential moves everywhere they went and these movements were "relatively constant" in the Southern Plains—especially when the entire period of Folsom occupation is taken into account. Hofman argues that they are doing residential and logistical moves even across different regions, although he acknowledges that it is reasonable to expect logistical and residential pattern variation across different environments and landscapes. Hofman states, regarding Folsom movement on the Southern Plains, that it is unclear whether it was characterized by "logistical task groups or residential units" (Hofman 1999b:404).

Sellet's (2013) Model. Sellet (2013) built a model for interpreting Folsom technological organization and strategies of weaponry production and replacement/repair (Sellet 2013: 384).

Sellet's (2013) model is relevant to interpreting where you are in the organization, repair, and production of Folsom technology. According to this model, the archaeological variability we see at a site resulted from how the prehistoric hunter-gatherers addressed future as well as immediate needs. Sellet argues that in order to untangle the strategies that played into technological organization one must first be able to recognize the archaeological signatures of two different strategies for Folsom hunters to manufacture their projectile points—which are 'gearing up' versus 'replacement/repair/retooling'. Folsom hunters needed not only to replace worn out, broken, and lost points, but sometimes they were making new points for future requirements (referred to as 'gearing up'). Sellet's (2013) model outlined the archaeological signatures for gearing up versus retooling or replacement. These strategies are described below. In addition, Figure 6.1 depicts a hypothetical cycle for the production and maintenance of Folsom technology.

Figure 6.1: Folsom Technology Production and Maintenance Cycle

Gearing up. Binford (1977 and 1978b) uses the term 'gearing up' to reflect circumstances in which, in anticipation of forthcoming hunts, people will make tools in surplus of their immediate requirements. Gearing up behavior occurs under conditions of reduced mobility, but technologically speaking it is a reaction to a highly mobile way of life (Sellet 2004:1563). Based on Sellet's (2013) model, in a situation where Folsom hunters are gearing up, we would expect that the proportion of preforms and channels to lost, broken, and worn out projectile points would show a large imbalance favoring the number of preforms and channels (evidence for point production) in relation to finished discarded (broken or expended) projectile points. In a gearing up situation, the emphasis is on the production end of technology. Under the strategy of gearing up, Folsom hunters produced projectile points in large quantities in preparation for a future hunt. Sellet's (2013) study of the Lindenmeier site revealed that a gearing up strategy of point production was seen in Area II of the site. In this area, Folsom hunters were manufacturing projectile points in excess of their immediate needs in anticipation of a future hunt. Lindenmeier II had a large number of preforms and channels in relation to discarded (broken and worn out) projectile points. We might expect that at places where Folsom hunters were camping longer (possibly close to lithic source areas and other resources) that a gearing up strategy might be expected. They may gear up at such sites, in preparation for hunting somewhere else.

Replacement or Retooling. In Sellet's (2013) model, he describes another strategy for Folsom hunters to manufacture their projectile points called 'replacement' or 'retooling.' Under a replacement or retooling strategy, they manufacture new projectile points to replace those that are worn out, lost, or broken. In this type of strategy, the ratio of preforms and channel flakes to discarded projectile points is approximately 1 to 1. That is, in a replacement or retooling type of strategy, the archaeological signature revealed a nearly equal proportion of broken and discarded projectile points in relation to preforms and channels. Sellet (2013) performed an analysis at the site-scale and at a larger-scale using many Folsom campsites. In the large-scale analysis, the majority of Folsom campsites exhibited a replacement or retooling strategy, with a ratio of 1 to 1 for manufactured points (as exhibited by preforms and channels) to discarded points. In other words, Folsom hunters were manufacturing new points to replace those that were broken, worn out, or lost. We might expect that Folsom hunters would use the strategy of replacement or retooling while in route or during an extended hunt.

Maintenance of an Equipment Set During a Hunt (While on the Move). While on an extended hunt, or during a hunting period, Folsom hunters may have used a strategy of maintenance when they were on the move. If Folsom hunters are just maintaining their equipment set while they are on the move, the archaeological signature may show a light mix of preforms and channel flakes (evidence for point production) versus a fair number of finished, discarded points (lost, worn out, or broken points). Thus, in this phase of the technological organization, the archaeological signature would show a greater number of discarded projectile points in relation to manufactured points (preforms and channels).

Hofman's (2003) Model. Another model of Folsom land use and technological organization that has regional scale implications is Hofman's (2003) study. In this study Hofman discusses long term land use patterns and directions of movement for regional-scale Folsom artifact distributions. This study focuses in part on an individual site, the Nolan site in Chase County, in western Nebraska. Hofman found a strong directional pattern for the movement of White River Group Silicates from the Flattop Butte source area (located in northeastern Colorado) southeastward and eastward into southwestern Nebraska and northeastern Colorado. This pattern stands in contrast to Smoky Hill Jasper, located closer to the Nolan site in southwestern Nebraska. Smoky Hill Jasper was rarely moved westward from primary sources of this material found in the Saline and Republican River Basins. Hofman's (2003) model interprets these patterns as the repeated movements of Folsom groups from lithic source areas to areas where they would hunt bison. According to Hofman's (2003) model, Folsom groups are operating out of an area with lithics and repeatedly going out and hunting and coming back. He interprets these to be long term land use patterns in the region. Hofman's model showed a strong pattern where Folsom hunters were repeatedly carrying White River Group Silicates eastward from the Flattop Butte source area into southwestern Nebraska and northeastern Colorado. In contrast, Smoky Hill Jasper was carried west from the source area into southwestern Nebraska only occasionally. This pattern is comparable to what Amick (1994; 1996) found in the Southern High Plains and Southwest, and fits with Sellet's (2013) model of gearing up near source areas for extended hunts.

Possible Scenarios for the Central Plains Dataset:

Scenario 1. One scenario for Folsom land use and technological organization is that the Central High Plains is used primarily as a hunting ground by Folsom people who lived some part of the year somewhere else—logically in the foothills of the Rocky Mountains (e.g., sites like Lindenmeier, Hell Gap, Cattle Guard, Westfall, etc.). This scenario proposes that Folsom people are not living in the Central Plains all the time—but instead they were coming in to the Central Plains seasonally to hunt. If this is the case, then we would expect that Folsom groups are gearing up to hunt before they move onto the Central High Plains; and that these same groups are mostly repairing and replacing worn out, broken, and lost points during the hunt. After hunting in the Central High Plains, groups would have returned to lithic source areas and the Plains margins (with varied resources) to gear up for future hunts. While on the move, during hunting in the

Central High Plains, they were mostly maintaining their hunting equipment. In this type of scenario we would not expect to see an archaeological signature for ‘gearing up’ or ‘replacement or retooling’ in Nebraska. While on the move, during the hunt in the Central Plains, we would see Folsom people maintaining a hunting equipment set—therefore the archaeological signature would show a pretty light mix of preforms and a fair number of discarded points. This scenario is analogous to Amick’s (1994; 1996) Folsom land use model where he found a difference between the Southern High Plains and Basin and Range in the American Southwest in terms of the proportions of preforms to finished projectile points. The Basin and Range had more preforms than the Southern High Plains. He found that the Southern High Plains was used primarily for hunting, while the Basin and Range was primarily habitation area for Folsom people in the Southwest.

Scenario 2. Another option for Folsom technological organization and land use in the Central Plains is that Folsom people were full-time residents of Nebraska. Under this scenario, full-time Central Plains residents were using a variety of lithic sources (e.g., gravel sources of Hartville Uplift Chert and Smoky Hill Jasper) where they lived. In this scenario, there are Folsom people who live in the Central Plains year-round, and thus they are not coming into the area to hunt—but instead they are hunting within the general area where they live. Under this type of scenario, areas with diverse resources (such as between the North and South Platte Rivers) could have enabled year-round residence for groups of Folsom people. In this case, the residents are going to be gearing up for hunting sometimes and repairing and replacing equipment at other times. In this option, the Central Plains, or specific areas within it, ought to reflect both archaeological signatures—‘gearing up’ and ‘replacing or retooling’ signatures—as suggested in Sellet’s (2013) model.

Scenario 3. A third scenario for the Central Plains dataset is that Folsom residents lived in Nebraska all the time, but they were doing logistical moves for lithics and other resources. They were living in the Central Plains—not the foothills of the Rockies—and they would make logistical trips to the foothills for lithics and possibly other resources such as special woods, and then return to the Central Plains to reside and hunt. In this scenario, Folsom people are living in Nebraska all the time and making logistical trips to Flattop, Hartville Uplift, and other sources—there they would do their production and then come back to the Central Plains. Because Folsom people would typically not finish fluting all their point preforms at the lithic source, under this scenario they would go to Hartville Uplift and Flattop sources and come back to the Central Plains carrying preforms and bifaces, as well as finished projectile points. Under this scenario we would also expect to see common preforms in the Central Plains Folsom dataset.

Patterns in the Central Plains Folsom Dataset:

The patterns in the Central Plains Folsom dataset can now be discussed in relation to the above models (i.e., Sellet 2013; Amick 1994, 1996; and Hofman 2003). This provides a step in evaluating Folsom land use and technological organization among the Central Plains Folsom groups.

Patterns in the Ratio of Preforms and Channel Flakes to Discarded Points for the Central Plains Dataset. Table 6.1 provides the number of preforms and channel flakes to discarded points for all ecoregions which contained artifact samples and the artifacts found in the North and South Platte area for the Central Plains Folsom sample.

Table 6.1: Number of Discarded Projectile Points to Preforms and Channel Flakes for Ecoregions and the North and South Platte River Streambeds in the Central Plains Folsom Dataset

ECOREGION	DISCARDED POINTS: PREFORMS AND CHANNELS	TOTAL # ARTIFACTS IN ECOREGION
WESTERN HIGH PLAINS	59 : 13	72
SOUTH PLATTE RIVER	45 : 27	72
NEBRASKA SAND HILLS	71 : 4	75
NORTH PLATTE RIVER	3 : 2	5
CENTRAL GREAT PLAINS	69 : 11	80
CORN BELT PLAINS	2 : 0	2
TOTALS	**249 : 57**	**306**

In table 6.1 we see that the Western High Plains (59:13), Nebraska Sand Hills (71:4), and Central Great Plains (69:11) had a light mix of preforms and channel flakes and a predominance of discarded points (broken, lost, and worn out points). Preforms and channels are obviously evidence of projectile point production. As discussed, a large number of preforms and channels in relation to discarded points can be evidence of gearing up for a future extended hunt. However, collectively, these three areas of Nebraska do not show evidence of a gearing up strategy. The South Platte River had a somewhat more even evidence for discarded points than point production with 45 worn out, lost, or broken points to 27 preforms and channel flakes. For this area there are less than two points for every preform. The North Platte River only has a small sample, which mirrors that of the South Platte. This pattern fits with ‘maintenance during a hunting period while on the move’ rather than ‘gearing up’.

As previously mentioned, Sellet’s (2013) model is useful for determining the assemblage’s position within the production, organization, and repair of Folsom technology. Figure 6.1 depicts the Folsom technology production and maintenance cycle and shows the relationship between ratios of preforms and channels to discarded points. Under a gearing up strategy, the emphasis is in on point production to prepare for a future extended hunt. In this strategy, we would expect more preforms and channels flakes than discarded points. In contrast, when Folsom hunters were using a strategy of retooling/replacement (maintenance) they would do repair and maintenance after a hunting event and we would expect the relationship between discarded points to preforms and channels to change to about a 1:1 ratio. However, when Folsom hunters were maintaining an equipment set during a hunting period, while on the move, we would expect the relationship between point production and discarded points to again shift—perhaps to reveal a relationship where the number of discarded points (because of lost projectiles and other factors) was greater than the number of preforms and channel flakes.

When we examine the patterns in the Central Plains Folsom sample it reveals that for four ecoregions and one river streambed in Nebraska the evidence showed a ratio where fewer preforms and channel flakes were found than discarded points. These areas are the South Platte River (45:27), Western High Plains (59:13), Nebraska Sand Hills (71:4), and Central Great Plains (69:11). The archaeological pattern seen in the Central Plains dataset points to 'maintenance during a hunting period while on the move' (see Figure 6.1). Fewer preforms and channel flakes than discarded points (worn out, broken, or lost) existed for three areas (i.e., the Western High Plains, Nebraska Sand Hills, and Central Great Plains regions). The South Platte River streambed is somewhat different with proportionately many more preforms represented than in the other areas—but still less than the 1:1 ratio anticipated by the repair and maintenance ('retooling'/ 'replacement') model. The patterns seen in the Central Plains dataset, in terms of the ratio of preforms and channel flakes to discarded points, is an archaeological signature for 'maintenance of an equipment set during a hunting period while on the move'. The weight given to these results depends in part on the factor of recognition and reporting of preforms and its potential impact on these numbers. However, if we take into account that the biases of preform recognition and reporting are minimal, then in general these results support Sellet's (2013) maintenance during a hunt.

This pattern can be argued to support an argument that the Central Plains Folsom dataset falls under Scenario 1. This scenario is that the Central Plains was used primarily as a hunting ground by Folsom people who lived elsewhere (probably in the foothills of the Rocky Mountains). This pattern reveals that Folsom people are just coming into the Central Plains to hunt probably seasonally—they do not live in the region all the time. The Central Plains Folsom pattern of preforms and channels to discarded points does not show an archaeological signature for 'gearing up' or 'replacement/retooling'. The pattern seen in the Central Plains dataset is one with a light mix of preforms and a fair number of discards. This pattern might imply that Folsom groups were maintaining an equipment set during a hunt and while on the move. Folsom groups would gear up for an extended hunt before heading out onto the Central Plains and would do their replacement, repair, and maintenance after they came back from the Central Plains. They were not living in the Central Plains year-round. The patterns seen in the preforms and channel flakes to discarded points for the Central Plains reveal that the area was used primarily as a hunting ground by Folsom groups and they lived elsewhere, logically in the foothills of the Rockies.

Alternatively, this pattern might also be expected if logistical moves were made from the Central Plains to lithic sources such as Flattop, and preforms from these sources were carried and occasionally broken in final production stages. In this model, Scenario 3, retooling logistical camps should occur near lithic source areas where there would be an abundance of discarded preforms and channel flakes in relation to discarded points. Preforms would then be underrepresented in the residential region of the Central Plains because only the failed preforms would be found.

Any discussion of regional-scale patterns where the data is not from excavated and well-documented sites and mostly from private collections must acknowledge the possible biases in the Central Plains Folsom sample in that the dataset probably has an under-representation of preforms, and certainly has an under-representation of channel flakes. However, if the collection biases of preform identification and collection are somewhat minimal, then the results of this measurement could be interpreted as revealing a larger number of discarded points in relation to fewer preforms and channels flakes. This might point to a strategy where Folsom hunters in the Western High Plains, Central Great Plains, Nebraska Sand Hills, and South Platte River of Nebraska were maintaining an equipment set while on the move during an extended hunting period.

Patterns in the Projectile Points to Preform Ratios for the Central Plains Dataset. The ratios of completed/finished projectile points to preforms was calculated for each ecoregion. When the ratio of projectile points to preforms is low (less than 5:1) this may indicate reduced mobility and a residential pattern of land use for an ecoregion. When the ratio of projectile points to preforms is low, this is indicative of the when the manufacturing of projectile points is relatively high and when broken points are frequently replaced. Amick’s (1994; 1996) model argues that this represents residential activities, under reduced mobility, with a pattern of land use that is residential. The replacement of weaponry is anticipated to be more constant while land use is not typified by logistical movement (Amick 1996:416). Therefore, Amick argues that low projectile point to preform ratios may indicate reduced mobility under a more residential pattern of land use.

When the ratio of projectile points to preforms is high (greater than 5:1) this may indicate high mobility under a more logistical pattern of land use for an ecoregion. At camps there will be more preforms and at kills there will be more projectile points. Areas or ecoregions used for hunting will have more finished points than those primarily used for camping. High projectile point to preform ratios indicate high rates of discarded points, and also indicate that the manufacture of projectile point replacements on-site is low. Amick's model (1996:414-416) argues that high point to preform ratios are expected when hunting bison, a resource that is somewhat unpredictable and mobile, and using high logistical mobility because the access to lithic material sources for replacement of projectile points may be decreased. Therefore, high point to preform ratios may indicate high mobility under a more logistical pattern of land use in terms of their hunting strategy and possibly in relation to lithics.

This current study used the ratio of 5.00 to distinguish between high and low projectile point to preform ratios because this allowed for direct interregional comparison, for this particular measurement of Folsom land use in Nebraska, with Amick's (1996:416-417) ratios of projectile points to preforms and the inferences of this measurement for Folsom land use for the American Southwest and Southern Plains. There are few Folsom datasets that are similar to the Central Plains Folsom dataset, and Amick's (1994; 1996) study is one of the few. His data is composed of mostly isolated artifact occurrences and includes only weaponry-related artifacts (projectile points, preforms, and channel flakes). Therefore, by using the ratio of 5.00 to distinguish between high and low projectile point to preform ratios, a direct intraregional comparison is possible between the Central Plains Folsom and the Southwest and Southern Plains.

Table 6.2: Projectile Point to Preform Ratios for the Central Plains Folsom Dataset

ECOREGION	PROJECTILE POINTS : PREFORMS (RATIO)
WESTERN HIGH PLAINS	59 : 7 (8.43)
SOUTH PLATTE RIVER	45 : 24 (1.88)
NEBRASKA SAND HILLS	71 : 4 (17.75)
NORTH PLATTE RIVER	3 : 2 (1.50)
CENTRAL GREAT PLAINS	69 : 11 (6.27)
CORN BELT PLAINS	2 : 0 (2.00)
TOTAL PROJECTILE POINTS : PREFORMS	**249 : 48**

Table 6.2 summarizes the ratios of projectile points to preforms for all ecoregions which contained artifact samples and the artifacts found in the North and South Platte Rivers for the Central Plains Folsom dataset. Results of this measure for the Central Plains Folsom dataset show the South Platte River streambed (1.88) had a low projectile point to preform ratio. The North Platte River (1.50) and Corn Belt Plains (2.00) also had low ratios for this measure, but sample sizes in these regions are extremely small. The Nebraska Sand Hills (17.75), Western High Plains (8.43), and Central Great Plains (6.27) had much higher ratios of projectile points to preforms.

The Central Plains Folsom preforms to projectile points pattern is pertinent to expectations of Amick's (1994; 1996) model of Folsom land use. Amick's study found a significant difference in the ratios of projectile points to preforms between the Basin and Range in the Southwest and the Southern High Plains. Amick found the Southern High Plains had fewer preforms (a high projectile point to preform ratio) than the Basin and Range areas of the Southwest (which in general had low projectile point to preform ratios). Amick (1994; 1996) argued this was because the Southern High Plains had a more logistical strategy of land use and the Basin and Range of New Mexico was characterized by a more residential strategy of land use. This model proposed that low projectile point to preform ratios indicated a reduced mobility pattern with land use that was residentially mobile. An emphasis exists on manufacturing replacements of broken points at residential locations. In contrast, the model also argued that high projectile point to preform ratios indicated high rates of discard of broken points and minimal manufacture of point replacements. Such a pattern occurs under conditions of high mobility such as occurs when hunting bison (Amick 1996:417).

The Central Plains Folsom sample has projectile point to preform ratios which show the Nebraska Sand Hills (17.75), Western High Plains (8.43), and Central Great Plains (6.27) had relatively high projectile point to preform ratios. These regions of Nebraska had relatively few preforms as compared to the number of projectile points. The evidence in the Nebraska Sand Hills, Western High Plains, and Central Great Plains reveals a large number of projectile point discards, with little evidence for projectile point manufacturing—this is the type of pattern we would expect if these areas of Nebraska were primarily used for hunting. The South Platte River streambed (1.88) had a low projectile point to preform ratio. Forty-five projectile points and 24 preforms came from the South Platte River area. This pattern could be interpreted as evidence that they are camping longer in the area and it may have served as a habitation area (at least seasonally). Whereas the other parts of the Central Plains may have been places where Folsom groups were primarily hunting and moving logistically.

The pattern seen in the South Platte River streambed may indicate that the floodplain, and perhaps gravel bars in the river channel, were good places to camp. Thus, Folsom people probably regularly used the South Platte flood plain and river channel for camping because of shelter and the wide variety of resources it offered. They would have lost or discarded artifacts in the channel. They may have also hunted bison as they crossed the river. Therefore, it should not be assumed that all Folsom artifacts found in the river channel came from elsewhere. The artifacts may have come from upstream in the river channel—they may have also come from eroded terraces deposits. Also, the reasons to use and camp in a river channel are many. River channels have water, lithics, wood, animals, and offer protection. So, the gravel bars and the flood plains are going to be targets for seasonal (or perhaps year round) occupation. When the river is flooded, one would not want to be in the channel. But, in the summer, fall, and winter the river channel would be a good place to camp. Therefore, it should not be assumed that the artifacts in the South Platte River channel necessarily came out of terrace deposits. Many artifacts recovered from the South Platte River channel probably started out some unknown distance upstream in the river channel. Folsom people may well have been using the South Platte River channel and low terraces on at least a seasonal basis for camping.

The Central Plains Folsom artifact patterns of ratios of points to preforms supports Scenario 1 and possibly Scenario 3 as well. The patterns seen in the Nebraska Sand Hills, Western High Plains, and Central Great Plains show high point to preform ratios which is characteristic of an area primarily used for hunting. In contrast, the low ratio of points to preforms in the South Platte River channel shows more of a habitation pattern. This makes sense when we think of the reasons Folsom groups would want to be along a river channel (water, wood, lithics, protection, animals). Folsom groups may not have lived year round in the South Platte River channel—but instead might have used it seasonally when they were hunting in the Central Plains. Scenario 1 points to the Central Plains being used primarily for hunting by Folsom groups who did not live there year round. Instead, based on lithic material sources, they likely lived in the foothills of the Rockies. In this scenario they geared up at lithic sources before moving out onto the Central Plains to hunt and then did most of their repairing and replacement of equipment after they returned from the hunt. The Central Plains ratios of points to preforms pattern supports and is analogous to Amick's (1994; 1996) model for the Southern High Plains and Basin and Range of the Southwest.

The Central Plains Folsom sample can be used to argue for and support Scenario 3. This scenario is one where Folsom residents lived in Nebraska all the time, but had logistical moves to the foothills of the Rockies for lithics and other resources. Then, they would return to the Central Plains to reside and hunt. In this scenario, they would make logistical trips to Flattop and Hartville sources and come back to the Central Plains carrying bifaces, preforms, and finished points. In this scenario, broken preforms would be common. In Scenario 3, the area between the North and South Platte Rivers would be a good place to live year round and would provide resources such as water, wood, shelter, and animals. Under this scenario, living in Nebraska year-round would involve logistical moves to the foothills for lithics.

*Lithic Material Patterns in the Central Plains Folsom Dataset***.** The three main identifiable lithic materials represented in the Central Plains Folsom dataset are White River Group Silicates (31.4% of the total sample), Hartville Uplift chert (24% of the total sample), and Smoky Hill Jasper (12.4% of the sample). A small number of Folsom artifacts in the Central Plains Folsom database are from more distant sources and these include Fossil Wood, Permian Florence "B" chert, Knife River Flint, Spanish Diggings Quartzite, Alibates, Edwards chert, Porcelanite, and Tongue River silicified sediment (Figure 5.1). Obviously White River Group Silicates and Hartville Uplift chert dominate the Central Plains Folsom dataset. Smoky Hill Jasper is significant, however, as its source areas are from a different direction and overlap with the study area.

The closest source for White River Group Silicates (WRGS) is Flattop Butte in Logan County in northeastern Colorado. Other sources are Horse Creek, South Dakota and Table Mountain, Wyoming. In addition WRGS washes out in residual gravels (Ahler 1977). Since Flattop Butte is the closest source, it was assumed to be the source for the majority of artifacts in the Central Plains Folsom dataset. WRGS Folsom artifacts were moved anywhere from 97 km into Morrill County (located in the western Nebraska panhandle) up to 395 km into Franklin County (located in south-central Nebraska) (see Table 5.5; Figure 5.2). WRGS Folsom artifacts were moved from the Flattop Butte source in a northeastern, eastern, and southeastern direction into western and southern Nebraska. Based on this evidence, there appears to be repeated movements of WRGS coming from the west. One way to distinguish logistical collection of WRGS from seasonal habitation at the source area would be if they were living at the source area seasonally, then we would expect to find more preforms at the source area than if they were performing logistical moves to the source area for lithics. If they are logistically collecting WRGS then they would come back to the area they reside carrying preforms, bifaces, and projectile points made of WRGS.

Hartville Uplift chert is the second most common lithic material in the Central Plains Folsom dataset. Sources for Hartville Uplift chert are in east-central Wyoming's Hartville Uplift and it is also found in secondary gravel deposits in the western Nebraska panhandle. Hartville Uplift chert was moved a minimum distance of 82 km to Sioux County (located in the northwest corner of Nebraska) to 540 km in Franklin County located in south-central Nebraska (Table 5.7; Figure 5.4). Hartville Folsom artifacts were moved from the source in east-central Wyoming in a northeastern, eastern, and southeastern direction into the western half of Nebraska. Based on evidence from the two most common lithic material types in the Central Plains Folsom database—WRGS and Hartville—there appears to be repeated movements of lithic materials into the Central Plains from the west.

Smoky Hill Jasper makes up an important minority of the Central Plains Folsom sample (38 artifacts, or 12.4% of the total). Primary sources for this lithic material are in the Republican and Saline River drainages in south-central Nebraska and northwestern Kansas and include the Medicine Creek Reservoir area in the Republican River Drainage in Frontier County, Nebraska. Smoky Hill Jasper was moved from the Medicine Creek area (the closest source) into Nebraska from the west, northwest, north, and southeast directions (Table 5.9, Figure 5.6). The distance from the Medicine Creek source to where the Folsom artifacts were found was between 75 km in Harlan County (located in south-central Nebraska along the southern tier of counties bordering Kansas) to 375 km in Sioux County (located in the far northwest corner of Nebraska). Hofman (2003: 239) reported that Folsom groups used Smoky Hill Jasper less frequently than did later Paleoindian complexes. Out of 306 artifacts in the Central Plains Folsom dataset, only 38 were made out of Smoky Hill Jasper. In general, the pattern seen in the Central Plains Folsom dataset for the Smoky Hill Jasper artifacts, is that despite the fact that sources of Smoky Hill Jasper are located closer, the dataset is dominated by White River Group Silicates and Hartville Uplift chert.

The patterns seen in the Central Plains dataset, in terms of the use of White River Group Silicates, Hartville Uplift, and Smoky Hill Jasper supports the patterns seen in Hofman's (2003) model. The pattern Hofman (2003) found at the Nolan site (in Chase County, Nebraska) and in the counties in southwest Nebraska and northeastern Colorado mirrors that seen in the Central Plains Folsom dataset. That is, Folsom artifacts made of White River Group Silicates were being transported to the east at a much greater rate than Smoky Hill Jasper artifacts were being transported to the west during Folsom times. The only way in which the Central Plains Folsom dataset varies from Hofman's (2003) model is that Hartville Uplift was also carried to the east at a higher rate than Smoky Hill Jasper was carried to the west during Folsom times. The patterns seen in the lithic materials of the Central Plains Folsom dataset appear to reflect repeated movements of lithic materials from the west (i.e., White River Group Silicates and Hartville Uplift chert), and movement of lithic materials to the east happens at only a fraction of the time (i.e., Smoky Hill Jasper). Smoky Hill Jasper does not seem to go west with the frequency that White River Group Silicates and Hartville Uplift chert move east. It is notable that Smoky Hill Jasper moves east with nearly as much frequency as it moves west. Folsom people were carrying Smoky Hill Jasper from the source to the east into the Republican and Blue River Valleys.

The lithic material patterns seen in the Central Plains Folsom dataset might support Scenario 1. Under this scenario, Folsom groups would gear up at lithic sources before they move onto the Central Plains, using the Central Plains primarily as a hunting ground. Folsom people would not live all year-round in the Central Plains, but instead would use the area seasonally or to hunt. Folsom groups would live some part of the year elsewhere—perhaps in the foothills of the Rockies. The Central Plains lithic material patterns support the hypothesis that Folsom groups would gear up at lithic sources (i.e., White River Group Silicates and Hartville Uplift) before moving onto the Central Plains to hunt, and then these same Folsom groups would mostly repair and replace broken, lost, and worn out points from the hunt after they returned from the Central Plains.

The lithic materials patterns in the Central Plains Folsom dataset do not appear to support Scenario 3, where Folsom groups were living in the Central Plains all the time, and performing logistical moves to the foothills of the Rockies for lithics. If Folsom groups were living in

Nebraska year round then we would expect that Smoky Hill Jasper would have been used in a higher frequency that what the data shows. The evidence seems to support seasonal moves (Scenario 1) to Flattop and Hartville rather than logistical moves (Scenario 3) to these sources.

Conclusion

This chapter addresses some questions about Folsom behavior in the Central Plains. These questions are as follows: Were Folsom people living in the area continuously—or instead were they exploiting specific areas in Nebraska on a seasonal basis? How would the Folsom archaeological record differ if they were living in the region year round versus only seasonally? Are Folsom people settling in the foothills and then using the High Plains for hunting (c.f. Amick 1994)? Is the direction of resource use (from lithic material source areas) proportionately equal to the directions of Folsom movement into the area from the west, east, north, and south (in proportion to the availability of lithic materials)?

The patterns in the ratios of preforms and channel flakes to discarded points, ratios of projectile points to preforms, and lithic materials in the Central Plains Folsom dataset point to a scenario where Folsom groups were not using the Central Plains all year round, but instead were exploiting the Western High Plains, Nebraska Sand Hills, Central Great Plains and South Platte River channel on a seasonal basis. The archaeological signature of the Central Plains Folsom dataset shows neither a 'gearing up' nor a 'replacement or retooling' strategy (c.f., Sellet 2013). Instead, a signature shows a strategy of 'maintaining an equipment set during a hunt while on the move'. The patterns in the Central Plains Folsom dataset point to Scenario 1 where there were repeated movements where Folsom groups were living in the foothills and gearing up at sources of White River Group Silicates and Hartville Uplift chert sources and heading out onto the Central Plains to hunt. The patterns in lithic materials show repeated (possibly seasonal) movement of lithic materials coming eastward into the Central Plains from the west, while Smoky Hill Jasper was moved westward only a fraction of the time (c.f., Hofman 2003). The patterns in the projectile points to preforms ratios for the Central Plains Folsom dataset could also possibly support Scenario 3, where they were living in the Central Plains year round and performing logistical moves to White River Group Silicates and Hartville Uplift sources. In general, the patterns in the Central Plains Folsom dataset enhance and support previous models of Folsom technological organization and landuse (i.e., Sellet 2013; Amick 1994, 1996; and Hofman 2003).

Chapter 7: Summary

The Central Plains Folsom study of land use and technological organization addressed several research questions including the following: Can the concentration of Folsom evidence near the confluence of the North and South Platte Rivers be attributed entirely to factors other than the behavior of Folsom people (such as geomorphic processes, modern population, land under cultivation, or archaeological research intensity)? Does the concentration of Folsom artifacts near the confluence of the North and South Platte Rivers reflect specific kinds of Folsom activity? Were Folsom groups living in the area continuously—or instead were they exploiting specific areas and resources in the Central Plains on a seasonal basis? How would the Folsom archaeological record differ if they were living in the region year round versus seasonally? Are Folsom people who live in the foothills of the Rocky Mountains simply using the High Plains for hunting (c.f., Amick 1994, 1996)? Is the direction of resource use (from lithic material source areas) proportionately equal to the directions of Folsom movement into the area from the west, east, north, and south (in proportion to the availability of lithic materials)? This dissertation began by posing these research questions and gave a background to the study area.

Goals of this study were to demonstrate the usefulness of using regional datasets to study land use at the regional scale of the Central Plains, and to evaluate the relevance of patterns in the Central Plains Folsom dataset in relation to some previous models of Folsom technological organization and land use. This chapter gives a brief summary of the high points of this dissertation.

In chapter 2, "Method and Theory for Regional Non-Site Archaeology and Folsom Period Research" the theory of regional 'off-site' archaeology is presented. Prior regional scale studies of Folsom, Clovis, and Paleoindian evidence, theories about land use of mobile hunters, and the limitations and possibilities of projectile-point based studies are reviewed.

Although we cannot assume that the Folsom culture had a land use system like the Nunamiut, Binford's (1983a, 1983b) ethnoarchaeological study demonstrated that hunter-gatherers can be expected to use a vast amount of space—much larger than archaeologists traditionally consider. Regional-scale studies must acknowledge limitations of relying mainly on hunting equipment. In addition, the ethical issues associated with using private collections are discussed and the limitations of inferring patterns of mobility from lithic raw material distributions are discussed.

In the third chapter, the overall spatial patterns of Folsom diagnostics is explored, including distributions of reduction stages, and projectile point fragment types. These patterns have the potential to inform us about elements of Folsom peoples' activities and their organization on the landscape.

Most Folsom artifacts in the sample were found in western Nebraska (Figure 3.1), with a secondary concentration in the southern tier of Nebraska counties. The absence of documented Folsom artifacts in the northeastern portion of the state is notable.

Broken preforms can indicate places where manufacturing and retooling of projectile points occurred. The Folsom preforms are concentrated in western Nebraska, with approximately half of them found in Keith and Lincoln counties which is at the confluence of the North and South Platte Rivers with another concentration in the southern and east-southern counties. The South Platte River had almost half of the preform sample.

Complete and nearly complete points may have been lost during hunting at kills or elsewhere. Blade and edge fragments probably also represent hunting activities. These fragments presumably are from projectile points broken during use while hunting. Most projectile point blade and edge fragments were found in the western half of the state. Projectile point bases may have been discarded intentionally and could indicate camps or retooling sites. Projectile point bases occur in the western half of Nebraska with another concentration in the southern and east-southern counties. The projectile point bases distribution is much more widespread than for projectile point tips.

Projectile point tips may be lost and left in animal carcasses and could indicate kill sites. Their distribution is less widespread than for projectile point bases. The primary concentration for projectile point tips is highest at the confluence of the North and South Platte Rivers.

Chapter 4 investigates the potential sampling biases in the sample. These include modern population, modern land use, archaeological research, and geomorphic factors. No correlation exists between modern population density and Folsom artifact density for any ecoregions in Nebraska.

Modern landuse (cultivation) was evaluated and revealed a small but insignificant negative correlation in both the Western High Plains and Central Great Plains regions. A significant negative correlation was found in the Nebraska Sand Hills and the Corn Belt Plains. There was a significant negative correlation between the percentage of cultivated land and Folsom artifact density. Land with more cultivation was less likely to yield Folsom artifacts in these regions. Because cropland is commonly on low terraces and these terraces are too young to have Folsom-age artifacts on their surfaces (cf. Mandel 2008). Folsom-aged cultural deposits are expected to occur in the T_2 and higher terraces.

Archaeological research intensity was evaluated as a sampling bias. Pearson's product-moment correlations were used to evaluate the potential relationship between Folsom artifact density and the intensity of archaeological research and revealed a small positive correlation for the Central Plains ecoregion, but the Western High Plains, Nebraska Sand Hills, and Corn Belt Plains had no correlation. None of these correlations were statistically significant.

Geomorphic factors can influence artifact patterning. Geomorphic factors considered included alluvial systems, sand hills, loess deposition, and climatic and vegetative changes that led to Holocene erosion and deposition. We need more systematic documentation in the Sand Hills because the current Clovis and Folsom distributions suggest there are exposures of Folsom-age deposits in the region. A high rate of erosion on uplands resulted in sediments being transported to streams “where it was deposited on alluvial fans and floodplains resulting in deep burial of Paleoindian-age landscapes” (Mandel 2008:359).

Loess deposition and re-deposition in the uplands of south-central, eastern, and northeastern areas of Nebraska could have buried Folsom artifacts. But, many of the uplands have exposures due to the considerable water and wind erosion that has occurred in these settings. Clovis surface artifacts have been found in eastern Nebraska (Holen 2003) so if Folsom people were active in eastern Nebraska we should expect that Folsom age artifacts would be exposed in this region.

The Clovis and Folsom distributions are distinctive. The Folsom artifact count was greater than for Clovis in each ecoregion with artifacts. This difference was statistically significant. The northeastern part of Nebraska has little Folsom evidence. This is not due to a lack of documentation of collections because Clovis are well-represented in northeastern Nebraska.

This investigation reveals that geomorphic factors such as alluvial valleys potentially bias Folsom artifact occurrences, while other factors (such as loess deposition, Holocene erosion, and sand dunes) are probably not biasing the Folsom distribution.

Chapter 5 examines patterns in lithic materials and reduction stages in the Folsom sample. White River Group Silicates (WRGS) are most common at the confluence of the North and South Platte Rivers. The majority are in western Nebraska with few in south-central Nebraska. Fifteen WRGS preforms were found in western Nebraska in the Western High Plains, Nebraska Sand Hills, and Central Great Plains ecoregions. WRGS channel flakes are from the Western High Plains and the South Platte River.

The overall distribution of Hartville Uplift artifacts (24.2% of the sample) reveals a concentration at the confluence of the North and South Platte Rivers. All of these artifacts occurred in the western half of Nebraska in the South Platte River, Nebraska Sand Hills, Western High Plains, and Central Great Plains ecoregions.

Hartville Uplift Folsom artifacts have a larger spatial distribution than WRGS artifacts. Both materials are concentrated in the Western half of the state, but Hartville is better represented in the central and northwestern portions than are WRGS artifacts. In the Western High Plains and South Platte River WRGS has a greater frequency. No WRGS or Hartville artifacts were found in the eastern and northeastern ecoregions of Nebraska.

The sample has eleven Folsom preforms of Hartville and all were found in the western half of the state. The greatest frequency was at the confluence of the North and South Platte Rivers. The South Platte River had the most Hartville preforms followed by the North Platte River, Nebraska Sand Hills, and Central Great Plains.

The Folsom artifacts made of Smoky Hill Jasper (SHJ) make up 12.4% of the total. The southern tier of Nebraska counties has the most SHJ artifacts. Harlan County in this area has the most SHJ artifacts and is located near a source of SHJ. The Central Great Plains ecoregion had the most SHJ artifacts, followed by the Western High Plains, South Platte River, and Nebraska Sand Hills.

Comparing the overall distribution and frequency of SHJ to WRGS and Hartville reveals that in every artifact category (Folsom points, Midland points, preforms, and channel flakes), WRGS and Hartville artifacts occur in higher frequencies than SHJ. In terms of the overall distribution, SHJ was found in 13 counties, WRGS was found in 15, and Hartville was found in 24. For both WRGS and Hartville, the greatest frequency was found at the confluence of the North and South Platte Rivers. Although SHJ artifacts were also found there, the greatest frequency of SHJ artifacts is found in the southern Nebraska counties. In the central and northwestern parts of Nebraska, Hartville is better represented than SHJ and WRGS. In the Central Great Plains, SHJ is better represented than WRGS and Hartville. However, in the Western High Plains, Nebraska Sand Hills, and South Platte River, both WRGS and Hartville have higher frequencies than SHJ. The SHJ sample had ten preforms from six counties, with the most from southern Nebraska.

There is a small overlap in the WRGS, Hartville, and SHJ Folsom preform distributions. Preforms capture an intermediate reduction stage not represented by finished points. WRGS, SHJ, and Hartville preforms were found distant from their sources which indicates that not all production occurred at the lithic material sources and when groups moved across the landscape they produced projectile points as needed.

The sample has 15 WRGS preforms found at an average distance of 188 km from the source (Table 5.5). The majority of the WRGS preforms were found at the confluence of the North and South Platte Rivers

Eleven Hartville preforms were found at an average distance of 294 km from the source area (Table 5.7). The majority of the Hartville preforms were found at the confluence of the North and South Platte Rivers. Ten SHJ preforms were found at a mean distance of 134 km from the source area (Table 5.9). Smoky Hill Jasper preforms were primarily found in the southern tier of counties.

Examination of WRGS, Hartville, and SHJ preforms revealed that some production was happening close to the source, and as Folsom groups moved and had kill events, there was a need to replenish their projectile points. Therefore other places on the landscape were point production places. The average distances that preforms were found from the source varied—with the shortest average distance being SHJ at 134 km (Table 5.9), the next shortest was WRGS preforms at 188 km from the source (Table 5.5), and finally, Hartville preforms at 294 km (Table 5.7).

Chapter 6 examined the Central Plains Folsom sample in relation to some previous models of Folsom land use and technological organization (Amick 1994, 1996; Sellet 2013; and Hofman 2003). Three possible scenarios for Folsom land use and technological organization for the Central Plains dataset were evaluated. In scenario 1, Folsom groups are not living in the Central Plains year-round, but instead lived elsewhere—likely in the foothills of the Rocky Mountains—and only came into the Central Plains to hunt. In this scenario, the archaeological signature would be one of ‘maintaining an equipment set during a hunt (while on the move).’ This signature would show a light mix of preforms and a greater number of discarded points and is analogous to Amick's (1994, 1996) model. In scenario 2, Folsom groups were living in Nebraska full-time and thus are hunting in an area where they live. The archaeological signature in this type of scenario would show 'gearing up' sometimes and 'replacement/repairing/retooling' at other times as outlined in Sellet's (2013) model. In scenario 3, Folsom groups were living in Nebraska year-round, but they made logistical trips to the foothills for lithics (i.e., White River Group Silicates at Flattop Butte, and Hartville Uplift chert) and probably other resources like special woods. They would then return to the Central Plains to live and hunt and would carry non-local preforms, bifaces, and finished points. In this third scenario we would expect to commonly see preforms in the Central Plains Folsom sample.

Patterns in the Central Plains Folsom dataset were examined in relation to previous models of Folsom land use and technological organization. The ratio of preforms and channel flakes to discarded points pattern fits with a 'maintenance during a hunting period while on the move' type of strategy rather than a 'gearing up' or 'replacement/retooling' strategy for projectile point production and maintenance (see Figure 6.1). The credibility of this result is dependent upon how much weight is given to the possible sampling bias of preform recognition and reporting by archaeologists and collectors. This pattern can be argued to support that the Central Plains was used primarily as a hunting area by Folsom groups who did not live in the Central Plains year round, but instead lived elsewhere, probably in the foothills of the Rockies (Scenario 1). In this scenario, Folsom groups would 'gear up' before heading out onto the Central Plains and then would do their 'replacement/repair/retooling' after returning from an extended hunt in the Central Plains. While hunting in the Central Plains, they used a 'maintaining an equipment set while on the move' strategy for projectile point production and maintenance.

An argument can also be made that the patterns in the ratio of discarded points to preforms and channel flakes in the Central Plains Folsom sample represent Scenario 3. In this scenario, Folsom groups lived in the Central Plains all the time, but made logistical trips to lithic sources. They would have returned from the lithic sources carrying preforms made of Flattop and Hartville Uplift chert. In this scenario, logistical camps should be located near the source areas. At these camps there would be a large number of discarded preforms in relation to discarded points (‘gearing up’). In this scenario, only failed preforms would be found in the Central Plains (the habitation area). Under this scenario, preforms would be underrepresented in the Central Plains, which is the case for most regions in the Central Plains.

The patterns in the projectile points to preforms ratios for the Central Plains Folsom sample were examined and revealed that the Western High Plains (8.43), Nebraska Sand Hills (17.75), and Central Great Plains (6.27) all had high ratios of projectile points to preforms (i.e., ratios that were greater than 5:1). All these regions had relatively high numbers of finished projectile points compared to the number of preforms. These regions had evidence for a high number of projectile point discards in comparison to relatively little evidence for the manufacturing of projectile points. This type of pattern would be expected if these areas were used primarily for hunting. In contrast, the South Platte River (1.88), North Platte River (1.50), and Corn Belt Plains (2.00) had low projectile point to preform ratios (however, the North Platte River and Corn Belt Plains had very small sample sizes). The South Platte River had 45 projectile points and 24 preforms. This is the type of pattern we would expect if they were camping longer in this area and it could have served as a habitation area. The gravel bars in the river are good places to camp as they offer a wide variety of resources (e.g., wood, water, lithics, shelter, and animals). They also could have hunted bison when they were watering or crossing in the river channel.

The pattern in the projectile points to preforms ratios for the Central Plains sample could be argued to support Scenario 1 and possibly Scenario 3. Scenario 1 is that the Central Plains was not used year round, but instead was primarily a hunting ground used by Folsom groups that lived outside the Central Plains (most logically in the foothills of the Rocky Mountains). This scenario is analogous to Amick's (1994,1996) model for the Southern High Plains and Basin and Range—where Folsom groups were using the High Plains for hunting and the Basin and Range area primarily as a habitation area. The patterns in the ratio of projectile points to preforms for the South Platte River show that they may have been using the river channel or confluence area for habitation on a seasonal basis while they were hunting in the Central Plains.

The pattern in the ratios of projectile points to preforms could also point to Scenario 3. In this scenario, Folsom groups were living in Nebraska all the time, and were making logistical trips to the foothills for resources such as special woods and lithics (i.e., Flattop and Hartville Uplift chert). In this scenario Folsom groups are hunting in the Central Plains, an area in which they lived. Under Scenario 3, the space between the North and South Platte Rivers would have been good places to live as the rivers provided shelter, animals, wood, lithics, and water.

Patterns in the lithic materials for the Folsom dataset were examined. White River Group Silicates (WRGS), Hartville Uplift chert, and Smoky Hill Jasper (SHJ) are the three main lithic materials. More than 31% of the total sample is made of WRGS, 24 % is Hartville, and 12.4% is SHJ. Other materials, mostly from further distant sources (i.e., Fossil Wood, Permian chert, Knife River Flint, Quartzite, Alibates, Edwards chert, Porcelanite, and Tongue River Silicified Sediment) are in the sample, but these materials make up a small proportion of the sample and could reflect trade or incidental usage. WRGS and Hartville dominate the sample, but SHJ makes up a significant minority and is interesting because the source areas for this material are from a different direction and occur differently with the study area than WRGS and SHJ.

Since Flattop Butte is the closest source to the study area for WRGS, it was assumed to be the source for the majority of the artifacts in the Central Plains Folsom sample. Based on the WRGS evidence in the sample, this material appears to be repeatedly moved from the west into the study area. If Folsom groups were living at the WRGS source area seasonally, we would expect to find a lot of preforms near the source area. If they were performing logistical moves to the source area for lithics, they would come back into Nebraska carrying WRGS preforms, bifaces, and finished points.

Hartville Uplift chert sources are found in the Hartville Uplift in east-central Wyoming. Hartville is also found in the western Nebraska panhandle in secondary gravel deposits. Folsom artifacts made of Hartville were moved from the Hartville source area into Nebraska in a northeastern, eastern, and southeastern direction. Based on the WRGS and Hartville evidence in the Central Plains Folsom sample, apparently lithic materials were moved repeatedly into Nebraska from the west.

The sample has 38 artifacts made of SHJ, making up a significant minority of the total sample. Primary sources for SHJ are in the Saline and Republican River drainages in northwestern Kansas and south-central Nebraska and include the Medicine Creek Reservoir area which lies in the Republican River Drainage in Frontier County. Smoky Hill Jasper was moved from the Republican River Drainage into Nebraska from southeastern, western, northwestern, and northern directions. The Central Plains Folsom sample for the SHJ artifacts is a pattern where we see that even though primary sources for SHJ are located closer, the sample is dominated by Hartville Uplift chert and WRGS.

The lithic material patterns seen in the three primary materials in the Central Plains Folsom sample support Hofman's (2003) model. This model found that WRGS Folsom artifacts were carried from the west to counties in southwest Nebraska, counties in northeastern Colorado, and the Nolan site which is located in Chase County in southwestern Nebraska. Folsom groups were moving WRGS eastward into southwestern Nebraska and northeastern Colorado at a much higher rate than SHJ artifacts were being carried westward into these same areas. The patterns seen in the lithic materials for the Central Plains Folsom sample enhance Hofman's (2003) model in that the present study found that, like the patterns seen for WRGS, Folsom groups were carrying Hartville Uplift chert to the east at a higher rate than SHJ was carried to the west, even though sources for SHJ were closer. Average distances for all Hartville, WRGS, and SHJ artifacts (from the source to the center of the county where the artifact was found) were 307 km for Hartville, 187 km for WRGS, and 141 km for SHJ.

The patterns in the lithic materials of the Central Plains Folsom sample would support Scenario 1. In this scenario, Folsom groups did not live in the Central Plains year round, but instead likely lived in the foothills of the Rockies. They would gear up at sources of WRGS or Hartville Uplift chert before heading into the Central Plains. They would use the Central Plains seasonally, or to hunt. They would repair and replace broken, lost, and worn out points after they returned from the Central Plains.

The patterns seen in the lithic materials of the Central Plains Folsom sample do not support Scenario 3. In Scenario 3, Folsom groups lived in the Central Plains year-round, but performed logistical moves to lithic sources in the foothills (i.e., WRGS and Hartville). If

Folsom groups were living in the Central Plains, then the patterns would show a much higher use of Smoky Hill Jasper than the data in the present study reveals.

In conclusion, the patterns in the Central Plains dataset support and enhance previous models of Folsom technological organization and land use (Amick 1994; 1996; Sellet 2013; and Hofman 2003). The patterns seen in the discarded points to preforms and channel flakes, ratios of projectile points to preforms, and lithic materials for the Central Plains Folsom dataset point to Scenario 1 where Folsom groups did not live in the Central Plains year-round. Instead, Folsom groups were gearing up at sources of WRGS and Hartville Uplift chert and then heading out onto the Central Plains to hunt (probably on a seasonal basis) in the Western High Plains, Central Great Plains, Nebraska Sand Hills, and South Platte River of Nebraska. They likely lived in the foothills of the Rocky Mountains instead of the Central Plains and used the Central Plains to hunt. This scenario is analogous to Amick's (1994, 1996) model for the Southern High Plains and Basin and Range. The Central Plains Folsom dataset has an archaeological signature that shows a 'maintaining an equipment set while on the move' type of strategy for the production and maintenance of their projectile points. The strategies of 'gearing up' and 'replacement or retooling' were not seen in the Central Plains Folsom sample (c.f., Sellet 2013). The lithic material patterns in the Central Plains Folsom dataset appear to reveal repeated movements of lithic materials from the west (i.e., White River Group Silicates and Hartville) coming eastward into the Central Plains. In contrast Smoky Hill Jasper was moved westward only a small portion of the time (c.f., Hofman 2003).

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Appendix: Nebraska Folsom Projectile Point, Preform, and Channel Flake Data

This appendix contains a table with data on the 306 Nebraska Folsom projectile points, preforms, and channel flakes used in this study. Note that a few specimen numbers are missing in this table. This is because some artifacts in the Nebraska Folsom database could not be assigned to a specific county and as such were not included in this study, and therefore not included in the table. A list identifying the categories and abbreviations used in the data table is given below.

Nebraska Folsom Database Specimen Number (NO): The specimen number that was given to each artifact. The specimen number begins with an "N" prefix followed by a numeral (e.g., N001, N002, N003….N320, N321).

Nebraska County (CO): The Nebraska county where the artifact was found.

Ecoregion (ECO): The ecoregion were the artifact was found.

- **CBP** = Corn Belt Plains
- **CGP** = Central Great Plains
- **NPR** = North Platte River
- **NSH** = Nebraska Sand Hills
- **SPR** = South Platte River
- **WHP** = Western High Plains

Lithic Material (MAT): The lithic material the artifact was made of.

- **ALI =** Alibates Flint
- **ED =** Edwards Plateau Chert
- **FW =** Fossil Wood
- **HV =** Hartville Uplift
- **KRF =** Knife River Flint
- **NJ =** Smoky Hill Jasper (also known as Niobrara Jasper)
- **POR =** Porcelanite
- **PRM =** Permian chert
- **QZT =** Quartzite
- **TRS** = Tongue River Silicified Sediment
- **UC** = Unknown chert
- **WRG =** White River Group Silicates

Artifact Type (TYPE): The type of artifact.

- **CHANNEL =** Channel Flake
- **FOLSOM** = Folsom Point
- **MIDLAND** = Midland Point
- **PREFORM =** Folsom Preform

Reworking (REWORK): Whether or not the artifact was reworked.

NA = Not Applicable
NO = Not reworked
UND = Undetermined in terms of reworking
YES = The artifact was reworked

Portion (POR): Portion of the artifact.

BA = Base
BBL = Base and Blade
BL = Blade
BL, EG = Blade and Edge
CO = Complete
EG = Edge
FR = Fragment
NC = Nearly Complete (just a tip or ear missing)
TP = Tip
TPB = Tip and Blade

NO	CO	ECO	MAT	TYPE	REWORK	POR
N001	CHASE	WHP	UC	FOLSOM	UND	NC
N002	CHASE	WHP	WRG	FOLSOM	YES	CO
N003	CHASE	WHP	WRG	FOLSOM	YES	CO
N004	CHASE	WHP	HV	FOLSOM	YES	CO
N005	CHASE	WHP	WRG	FOLSOM	UND	BA
N006	CHASE	WHP	WRG	FOLSOM	UND	BA
N007	CHASE	WHP	NJ	FOLSOM	UND	BA
N008	CHASE	WHP	NJ	FOLSOM	UND	TP
N009	CHASE	WHP	WRG	FOLSOM	UND	TP
N010	CHASE	WHP	WRG	PREFORM	NA	TPB
N011	CHASE	WHP	WRG	PREFORM	NO	BA
N012	CHASE	WHP	NJ	MIDLAND	NO	BL
N013	BANNER	WHP	NJ	MIDLAND	UND	CO
N014	HITCHCOCK	CGP	WRG	FOLSOM	NO	CO
N015	HARLAN	CGP	HV	FOLSOM	NO	BA
N016	HARLAN	CGP	WRG	FOLSOM	NO	BA
N017	HARLAN	CGP	NJ	FOLSOM	NO	BA
N018	HARLAN	CGP	NJ	PREFORM	NA	BA
N019	HARLAN	CGP	WRG	MIDLAND	YES	NC
N020	HARLAN	CGP	ED	FOLSOM	NO	BBL
N021	HARLAN	CGP	WRG	FOLSOM	UND	BL
N022	HARLAN	CGP	NJ	FOLSOM	UND	CO
N023	HARLAN	CGP	NJ	PREFORM	NA	BA
N024	HARLAN	CGP	NJ	FOLSOM	UND	TP
N025	HARLAN	CGP	PRM	FOLSOM	NO	BL
N026	LOUP	NSH	HV	FOLSOM	UND	BBL
N027	BLAINE	NSH	HV	FOLSOM	UND	CO
N028	BLAINE	NSH	HV	FOLSOM	UND	BL
N029	BLAINE	NSH	HV	FOLSOM	YES	CO
N030	BLAINE	NSH	HV	FOLSOM	YES	NC
N031	CHASE	WHP	WRG	FOLSOM	NO	BA
N032	CHASE	WHP	WRG	FOLSOM	NO	TP
N033	CHASE	WHP	NJ	MIDLAND	NO	BA
N034	CHERRY	NSH	UC	FOLSOM	UND	FR
N035	SHERIDAN	NSH	WRG	FOLSOM	YES	CO
N036	SHERIDAN	NSH	WRG	FOLSOM	NO	CO
N037	SHERIDAN	NSH	WRG	FOLSOM	UND	NC
N038	SHERIDAN	NSH	UC	FOLSOM	UND	BL
N040	HOOKER	NSH	FW	FOLSOM	UND	CO
N041	LINCOLN	CGP	WRG	FOLSOM	YES	NC
N042	HALL	CGP	UC	FOLSOM	YES	CO
N043	CHERRY	NSH	HV	FOLSOM	NO	BA
N044	LINCOLN	CGP	NJ	FOLSOM	NO	TP
N045	LINCOLN	CGP	WRG	FOLSOM	NO	BL
N046	HOOKER	NSH	HV	FOLSOM	YES	NC
N047	LOUP	NSH	NJ	PREFORM	NO	BBL
N048	LINCOLN	CGP	FW	MIDLAND	YES	CO

N049	LINCOLN	CGP	HV	MIDLAND	NO	BA
N050	LINCOLN	CGP	ALI	MIDLAND	NO	BA
N051	LINCOLN	CGP	KRF	MIDLAND	NO	BA
N052	LINCOLN	CGP	WRG	MIDLAND	NO	BA
N053	LINCOLN	CGP	HV	MIDLAND	NO	BA
N054	LINCOLN	CGP	HV	MIDLAND	NO	BA
N055	LANCASTER	CBP	KRF	FOLSOM	YES	CO
N056	CHASE	WHP	UC	FOLSOM	UND	BA
N057	DUNDY	WHP	WRG	FOLSOM	NO	BL
N058	LINCOLN	CGP	PRM	FOLSOM	NO	CO
N059	FRANKLIN	CGP	HV	FOLSOM	NO	BA
N060	DAWES	WHP	HV	FOLSOM	NO	BL
N061	BROWN	NSH	HV	FOLSOM	NO	BL
N062	THOMAS	NSH	UC	FOLSOM	NO	BA
N063	THOMAS	NSH	WRG	FOLSOM	NO	BA
N064	THOMAS	NSH	UC	FOLSOM	NO	BA
N065	THOMAS	NSH	HV	FOLSOM	NO	BA
N066	HOOKER	NSH	WRG	FOLSOM	YES	CO
N067	LINCOLN	CGP	UC	FOLSOM	UND	TP
N068	MCPHERSON	NSH	UC	FOLSOM	UND	CO
N069	HOOKER	NSH	UC	FOLSOM	NO	BA
N070	MCPHERSON	NSH	WRG	FOLSOM	UND	TP
N071	LINCOLN	CGP	UC	FOLSOM	UND	TP
N072	HOOKER	NSH	UC	FOLSOM	UND	BL
N073	HOOKER	NSH	HV	FOLSOM	NO	BA
N074	LINCOLN	CGP	NJ	FOLSOM	UND	TP
N075	MCPHERSON	NSH	QZT	FOLSOM	UND	BA
N076	MCPHERSON	NSH	UC	FOLSOM	NO	TP
N077	CHASE	WHP	WRG	FOLSOM	NO	BA
N078	RED WILLOW	CGP	UC	FOLSOM	YES	CO
N079	DUNDY	WHP	WRG	FOLSOM	YES	CO
N080	CHERRY	NSH	UC	FOLSOM	UND	BA
N081	CHASE	WHP	UC	FOLSOM	UND	BA
N082	DUNDY	WHP	WRG	FOLSOM	YES	BBL
N083	BANNER	WHP	UC	FOLSOM	UND	BA
N084	BOX BUTTE	WHP	HV	FOLSOM	YES	CO
N085	HOOKER	NSH	NJ	FOLSOM	UND	BBL
N086	DAWSON	CGP	HV	FOLSOM	UND	BA
N087	THAYER	CGP	NJ	PREFORM	NA	CO
N088	SIOUX	WHP	NJ	FOLSOM	UND	TP
N089	PAWNEE	CBP	PRM	FOLSOM	NO	BA
N090	KEITH	WHP	QZT	FOLSOM	UND	BL
N091	KEITH	WHP	UC	MIDLAND	NO	BL
N092	SIOUX	WHP	UC	MIDLAND	NO	BBL
N093	CHASE	WHP	WRG	FOLSOM	NO	BA
N094	CHASE	WHP	UC	MIDLAND	UND	BA
N095	DUNDY	WHP	WRG	FOLSOM	YES	CO
N096	NUCKOLLS	CGP	NJ	PREFORM	NO	CO

N097	NUCKOLLS	CGP	NJ	FOLSOM	UND	BA
N098	THAYER	CGP	NJ	PREFORM	NO	BBL
N099	NUCKOLLS	CGP	NJ	FOLSOM	YES	BA
N101	NUCKOLLS	CGP	UC	FOLSOM	YES	NC
N102	NUCKOLLS	CGP	PRM	PREFORM	NO	BBL
N103	CUSTER	CGP	UC	FOLSOM	NO	BL
N104	CUSTER	CGP	HV	FOLSOM	YES	NC
N105	LINCOLN	CGP	WRG	PREFORM	NO	BBL
N106	KEITH	NPR	HV	FOLSOM	NO	CO
N107	KEITH	SPR	WRG	PREFORM	NA	CO
N108	LINCOLN	SPR	WRG	FOLSOM	YES	NC
N109	KEITH	SPR	FW	FOLSOM	UND	BA
N110	KEITH	SPR	FW	PREFORM	NO	BA
N111	KEITH	SPR	TRS	PREFORM	YES	CO
N112	KEITH	SPR	HV	FOLSOM	UND	EG
N113	KEITH	WHP	UC	PREFORM	NA	BBL
N114	KEITH	SPR	WRG	CHANNEL	NA	BL
N115	KEITH	SPR	WRG	PREFORM	YES	CO
N116	KEITH	SPR	WRG	FOLSOM	YES	NC
N118	KEITH	SPR	WRG	FOLSOM	UND	BL
N119	KEITH	WHP	QZT	FOLSOM	UND	CO
N120	KEITH	SPR	WRG	FOLSOM	NO	CO
N121	KEITH	SPR	WRG	FOLSOM	UND	CO
N122	KEITH	WHP	UC	FOLSOM	UND	
N123	LINCOLN	SPR	HV	PREFORM	NO	CO
N124	LINCOLN	SPR	HV	PREFORM	NA	CO
N125	LINCOLN	SPR	WRG	FOLSOM	UND	TP
N126	MORRILL	WHP	WRG	MIDLAND	UND	BA
N127	MORRILL	WHP	WRG	MIDLAND	UND	BBL
N128	LINCOLN	SPR	WRG	PREFORM	NA	NC
N129	KEITH	SPR	HV	FOLSOM	UND	BL
N130	KEITH	SPR	NJ	FOLSOM	UND	NC
N131	KEITH	SPR	WRG	FOLSOM	NO	BL
N132	KEITH	SPR	HV	PREFORM	NO	CO
N133	KEITH	SPR	NJ	FOLSOM	YES	BBL
N134	KEITH	SPR	HV	FOLSOM	YES	CO
N135	ARTHUR	NSH	HV	FOLSOM	YES	CO
N136	MCPHERSON	NSH	HV	FOLSOM	UND	BA
N137	LINCOLN	SPR	WRG	PREFORM	NA	BBL
N138	LINCOLN	CGP	WRG	FOLSOM	YES	CO
N140	LINCOLN	CGP	HV	FOLSOM	YES	CO
N141	LINCOLN	SPR	WRG	PREFORM	NO	BA
N142	LINCOLN	SPR	WRG	PREFORM	NO	BL
N143	LINCOLN	SPR	WRG	FOLSOM	NO	TPB
N144	MCPHERSON	NSH	UC	FOLSOM	YES	CO
N145	MCPHERSON	NSH	HV	FOLSOM	YES	NC
N146	LINCOLN	CGP	NJ	FOLSOM	UND	BBL
N147	MCPHERSON	NSH	WRG	FOLSOM	NO	BBL

N148	MCPHERSON	NSH	WRG	FOLSOM	NO	NC
N149	LINCOLN	SPR	FW	FOLSOM	NO	BA
N150	LINCOLN	SPR	UC	PREFORM	NO	CO
N151	KEITH	SPR	WRG	FOLSOM	NO	CO
N152	KEITH	SPR	HV	FOLSOM	NO	CO
N153	KEITH	WHP	NJ	FOLSOM	UND	BA
N154	KEITH	SPR	WRG	FOLSOM	NO	NC
N155	KEITH	SPR	HV	FOLSOM	NO	TP
N156	MCPHERSON	NSH	WRG	FOLSOM	UND	CO
N157	KEITH	WHP	QZT	FOLSOM	NO	BA
N158	KEITH	SPR	FW	FOLSOM	YES	TPB
N159	KEITH	WHP	ALI	MIDLAND	NO	CO
N160	LINCOLN	CGP	HV	FOLSOM	UND	BBL
N161	LINCOLN	SPR	NJ	PREFORM	NO	BBL
N162	LINCOLN	SPR	WRG	CHANNEL	NA	BL
N163	LINCOLN	SPR	FW	FOLSOM	UND	BA
N164	LINCOLN	SPR	HV	PREFORM	UND	BBL
N165	MCPHERSON	NSH	WRG	FOLSOM	YES	CO
N166	LINCOLN	CGP	WRG	FOLSOM	NO	TP
N167	MCPHERSON	NSH	KRF	FOLSOM	UND	CO
N168	MCPHERSON	NSH	WRG	FOLSOM	NO	BA
N169	MCPHERSON	NSH	WRG	FOLSOM	YES	NC
N170	LINCOLN	SPR	NJ	PREFORM	NO	TPB
N171	MCPHERSON	NSH	FW	MIDLAND	NO	BA
N172	KEITH	SPR	WRG	FOLSOM	UND	CO
N173	MCPHERSON	NSH	WRG	FOLSOM	YES	CO
N174	DUNDY	WHP	WRG	FOLSOM	UND	NC
N175	DUNDY	WHP	HV	FOLSOM	UND	BL
N176	KEITH	NPR	UC	FOLSOM	NO	BBL
N177	KEITH	SPR	FW	FOLSOM	NO	TP
N178	KEITH	SPR	WRG	PREFORM	NA	CO
N179	KEITH	SPR	WRG	FOLSOM	YES	CO
N180	KEITH	SPR	WRG	FOLSOM	YES	CO
N181	KEITH	SPR	HV	FOLSOM	NO	TP
N182	KEITH	SPR	WRG	FOLSOM	NO	BBL
N183	KEITH	SPR	HV	FOLSOM	UND	NC
N184	KEITH	NPR	HV	PREFORM	NA	BBL
N185	KEITH	SPR	WRG	FOLSOM	NO	TP
N186	KEITH	SPR	FW	FOLSOM	NO	CO
N188	KEITH	SPR	WRG	MIDLAND	NO	CO
N189	KEITH	SPR	FW	MIDLAND	YES	CO
N190	KEITH	SPR	WRG	FOLSOM	YES	NC
N191	KEITH	SPR	FW	PREFORM	NA	BA
N192	KEITH	SPR	FW	CHANNEL	NA	BL
N193	KEITH	SPR	FW	PREFORM	NA	BA
N194	KEITH	SPR	WRG	PREFORM	NA	BA
N195	SHERIDAN	NSH	WRG	FOLSOM	YES	CO
N196	ARTHUR	NSH	WRG	MIDLAND	UND	BA

N197	RED WILLOW	CGP	UC	FOLSOM	YES	NC
N199	KEITH	WHP	WRG	MIDLAND	UND	BA
N200	KEITH	WHP	WRG	MIDLAND	UND	BA
N201	KEITH	WHP	HV	MIDLAND	UND	BA
N202	KEITH	WHP	POR	MIDLAND	UND	BBL
N204	KEITH	SPR	HV	FOLSOM	UND	TP
N205	DEUEL	SPR	HV	PREFORM	NA	BA
N206	DEUEL	SPR	HV	FOLSOM	UND	TP
N207	CUSTER	CGP	HV	FOLSOM	YES	CO
N209	DAWSON	CGP	FW	FOLSOM	UND	CO
N210	SCOTTS BLUFF	NPR	HV	PREFORM	NA	BBL
N211	HARLAN	CGP	KRF	FOLSOM	YES	TP
N212	KEITH	WHP	ED	PREFORM	NA	
N213	HARLAN	CGP	NJ	MIDLAND	UND	NC
N214	HARLAN	CGP	NJ	PREFORM	NO	CO
N215	DEUEL	SPR	FW	PREFORM	NA	BBL
N216	KEITH	SPR	FW	FOLSOM	NO	CO
N217	KEITH	SPR	WRG	FOLSOM	NO	NC
N218	KEITH	SPR	HV	FOLSOM	UND	BA
N219	DEUEL	SPR	HV	FOLSOM	YES	BA
N220	DEUEL	SPR	WRG	FOLSOM	YES	CO
N221	DEUEL	SPR	HV	FOLSOM	YES	TP
N222	DEUEL	SPR	NJ	FOLSOM	UND	BL
N223	JEFFERSON	CGP	PRM	PREFORM	NA	CO
N224	HOOKER	NSH	HV	FOLSOM	YES	CO
N225	HOOKER	NSH	HV	FOLSOM	UND	CO
N226	GRANT	NSH	UC	FOLSOM	UND	
N227	CHERRY	NSH	UC	FOLSOM	YES	CO
N229	CHERRY	NSH	UC	FOLSOM	YES	CO
N230	CHERRY	NSH	UC	FOLSOM	UND	CO
N231	SHERIDAN	NSH	UC	FOLSOM	YES	NC
N232	CHERRY	NSH	KRF	FOLSOM	YES	NC
N234	SIOUX	WHP	UC	FOLSOM	UND	NC
N235	JEFFERSON	CGP	PRM	FOLSOM	UND	BL
N236	JEFFERSON	CGP	PRM	FOLSOM	UND	BBL
N237	JEFFERSON	CGP	PRM	FOLSOM	UND	BA
N238	KEITH	SPR	HV	FOLSOM	NO	BL
N239	CHASE	WHP	WRG	FOLSOM	UND	CO
N240	DUNDY	WHP	NJ	FOLSOM	NO	CO
N241	DUNDY	WHP	WRG	FOLSOM	YES	BL
N242	DUNDY	WHP	ALI	FOLSOM	UND	BA
N244	KEITH	WHP	WRG	FOLSOM	NO	TP
N245	KEITH	SPR	WRG	FOLSOM	UND	CO
N246	HOOKER	NSH	WRG	FOLSOM	UND	BL
N247	HOOKER	NSH	HV	FOLSOM	UND	CO
N248	HOOKER	NSH	HV	FOLSOM	YES	CO
N249	HOOKER	NSH	NJ	FOLSOM	UND	CO
N250	HOOKER	NSH	WRG	PREFORM	NA	CO

N251	HOOKER	NSH	HV	PREFORM	NA	BBL
N252	KEITH	WHP	HV	CHANNEL	NA	BL
N254	JEFFERSON	CGP	PRM	PREFORM	NA	CO
N255	CHERRY	NSH	HV	PREFORM	NA	BA
N256	HARLAN	CGP	NJ	FOLSOM	NO	NC
N257	DEUEL	WHP	HV	FOLSOM	UND	CO
N259	LINCOLN	CGP	HV	FOLSOM	UND	BA
N260	LINCOLN	CGP	FW	FOLSOM	UND	BA
N261	LINCOLN	CGP	HV	PREFORM	NA	BA
N262	LINCOLN	CGP	UC	FOLSOM	UND	TP
N263	LINCOLN	CGP	UC	FOLSOM	UND	TP
N264	LINCOLN	CGP	UC	FOLSOM	UND	TP
N265	LINCOLN	CGP	UC	FOLSOM	UND	BL
N266	LINCOLN	CGP	UC	FOLSOM	UND	BL
N267	LINCOLN	CGP	UC	FOLSOM	UND	BA
N268	LINCOLN	CGP	UC	FOLSOM	UND	BL, EG
N269	BOONE	CGP	UC	FOLSOM	YES	CO
N270	MORRILL	NPR	UC	FOLSOM	UND	CO
N271	KEITH	SPR	HV	PREFORM	NO	TPB
N272	KEITH	SPR	WRG	PREFORM	NA	TP
N273	KEITH	SPR	UC	PREFORM	NA	CO
N274	KEITH	SPR	UC	MIDLAND	UND	TP
N275	CUSTER	CGP	HV	FOLSOM	YES	BBL
N276	FRANKLIN	CGP	WRG	FOLSOM	UND	BBL
N277	HARLAN	CGP	NJ	FOLSOM	UND	BBL
N278	HARLAN	CGP	NJ	FOLSOM	YES	BBL
N279	NUCKOLLS	CGP	FW	FOLSOM	UND	BA
N281	HARLAN	CGP	HV	FOLSOM	YES	CO
N283	NUCKOLLS	CGP	PRM	FOLSOM	UND	BA
N284	CHASE	WHP	NJ	PREFORM	NO	TPB
N285	CHASE	WHP	WRG	PREFORM	NO	TP
N286	CHASE	WHP	WRG	PREFORM	NA	TP
N287	CHASE	WHP	WRG	CHANNEL	NA	BL
N288	CHASE	WHP	HV	CHANNEL	NA	BL
N289	CHASE	WHP	WRG	CHANNEL	NA	BL
N290	CHASE	WHP	WRG	CHANNEL	NA	BL
N291	CHASE	WHP	WRG	CHANNEL	NA	BL
N292	KEITH	WHP	FW	FOLSOM	UND	BL
N293	LINCOLN	CGP	HV	MIDLAND	NO	BBL
N294	CHASE	WHP	HV	MIDLAND	YES	CO
N295	KEITH	WHP	WRG	FOLSOM	UND	BL
N296	SHERIDAN	NSH	HV	FOLSOM	YES	NC
N297	MORRILL	WHP	HV	FOLSOM	YES	CO
N298	CHASE	WHP	WRG	FOLSOM	YES	CO
N299	CHASE	WHP	ALI	FOLSOM	YES	CO
N300	KEITH	WHP	HV	FOLSOM	NO	BA
N301	SIOUX	WHP	HV	FOLSOM	NO	BA
N302	SIOUX	WHP	HV	FOLSOM	NO	BBL

N303	LINCOLN	CGP	UC	FOLSOM	NO	BA
N304	LINCOLN	CGP	WRG	FOLSOM	UND	BL, EG
N305	LINCOLN	CGP	NJ	FOLSOM	UND	BL
N306	GARDEN	NSH	HV	FOLSOM	YES	NC
N307	GARDEN	NSH	FW	FOLSOM	NO	BBL
N308	GARDEN	NSH	WRG	FOLSOM	YES	BBL
N309	GARDEN	NSH	HV	MIDLAND	NO	CO
N310	GARDEN	NSH	KRF	FOLSOM	UND	BA
N311	GARDEN	NSH	NJ	FOLSOM	UND	BA
N312	GARDEN	NSH	WRG	FOLSOM	UND	TP
N313	GARDEN	NSH	ALI	FOLSOM	UND	BL
N314	GARDEN	NSH	WRG	FOLSOM	UND	TP
N315	GARDEN	NSH	HV	FOLSOM	UND	TP
N316	GARDEN	NSH	WRG	FOLSOM	UND	NC
N317	GARDEN	NSH	HV	FOLSOM	UND	BA
N318	GARDEN	NSH	QZT	FOLSOM	UND	TP
N319	GARDEN	NSH	FW	FOLSOM	UND	BA
N320	GARDEN	NSH	WRG	FOLSOM	NO	BL
N321	THAYER	CGP	NJ	FOLSOM	NO	CO

Note: A few specimen numbers are missing in this table. This is because some artifacts in the Nebraska Folsom database could not be assigned to a specific county and as such were not included in this study, and therefore not included in the table.